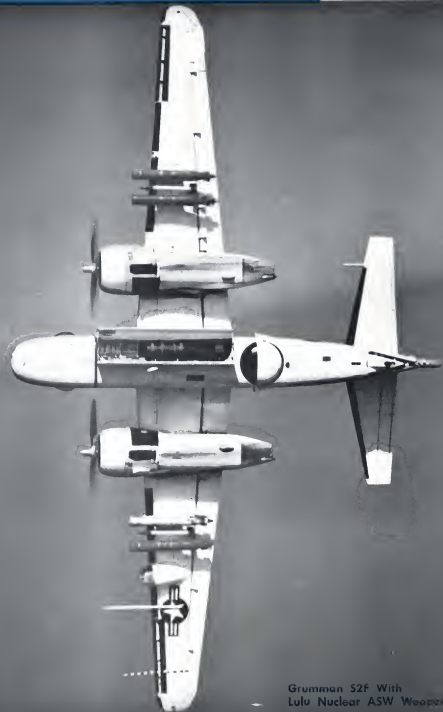


January 2, 1961

# Aviation Week

*and Space Technology*

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Grumman S2F With  
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Jan. 9-13—Sixteenth National Symposium on Reliability and Quality Control, Bellevue-Stratford Hotel, Philadelphia, Pa.

Jan. 10-12—Annual Meeting, American Engineering Society of Automotive Engineers, Cobo Hall, Detroit, Mich.

Jan. 13-18—43rd Annual Convention, Institution of Mechanical Engineers, 11, Bedford Square, London, W.C.1, England.

Jan. 14-18—Seventh Annual National Meeting, American Astronautical Society, Dallas, Texas.

Jan. 17-19—Winter Instrumentation Conference & Exhibit, Instrument Institute of Japan, Hotel New Otowa, Tokyo, Japan.

Jan. 22-24—Annual Meeting, Army of Local Transport Engineers, National Armaments Research Institute, Tokyo, Japan.

Jan. 23-28—65th Annual Meeting, Institute of the Aeronautical Sciences, Hotel Astor, New York, N. Y. Honors Night Dinner, Jan. 27.

Feb. 3-5—Second World Military Electronics Conference, Institute of Radio Engineers, Elmhurst Hotel, Los Angeles, Calif.

Feb. 4-6—Annual Meeting, American Nuclear Society, Sheraton Hotel, Salt Lake City, Utah.

Feb. 14-18—Second Annual Symposium on Nondestructive Testing of Aircraft and Spacecraft, General Electric Research & Development Center, Schenectady, New York.

Feb. 17-19—International Solid-State Circuits Conference, Institute of Radio Engineers, Sheraton Hotel, Philadelphia, Pa.

Feb. 18-20—Annual Meeting, American Society of Mechanical Engineers, Society of

(Continued on page 6)

**January 2, 1966**  
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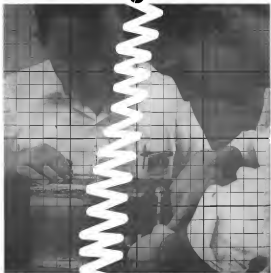
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## EDITORIAL

### Thin Edge of the Wedge

The latest use of a Russian-made Ilyushin H transport to drop arms and supplies to the Laotian rebels in Indo-China (see picture on page 25) should serve to emphasize again the manner in which the Soviet Union is using both its growing fleet of gas turbine-powered transports and its surplus of potent power equipment as the thin edge of what could develop into a powerful wedge for Soviet penetration.

The startling growth of Soviet strength in air transport has been evident to even the most casual observer of the Aeroflot scene during the past three years. But there has been a tendency, particularly by U.S. airline experts used to the technical softnesses dominated by sharp commercial competition, to underestimate the value of this Soviet transport fleet in the international arena. The fact that most of this Soviet equipment, both piston and gas turbine-powered, would have difficulty in competing in the international airline market on purely economic terms has tended to divert these experts from the value of this equipment when shrewdly deployed as an instrument for expanding Soviet influence in the underdeveloped or politically fracturing countries of the world.

#### Economic Weapon

The growing Soviet transport fleet is promoting the USSR with a number of assets:

- First, it is making a tremendous contribution to the overall economic development of the Soviet Union by providing an element of transport and communication never before possible in the vast reaches of the 19 Soviet states.
- Second, it is providing Soviet military power with a mobility and flexibility it has never before enjoyed. The Western world has yet to feel the impact of this vital new factor in the Soviet military equation, but it is already there and must be reckoned with. The air drops in Laos and the recent penetration of the Congo by Ilyushinborne Russians are significant moves in this regard.
- Third, it is promoting the thin edge of the wedge for eventual large scale economic penetration of key areas, paving the way for their eventual absorption into the Soviet colonial empire.

Although only a few years ago it was the fashion among U.S. transport "experts" to scoff at the idea that Soviet aviation equipment would ever be any threat in the international market, the initial steps in this penetration are now on the record for all to read. Soviet transport equipment has now penetrated beyond the satellite belt to Africa, India, and the Middle East. The pace economics of these experts is secondary to those nations who have an urgent problem that only air transport

can solve, and of course, the political profit from these deals is carefully computed by the Soviets as shoring their power for this equipment or is amassing suitable buffer deals.

A good case history on the impact of this Soviet export drive was provided in the Dec. 12 issue of *Aerospace Week* (p. 38) reporting on the growth of China Airways. In areas where the Soviet threat is too formidable for direct negotiations, the Soviets are active in offering Soviet transports and technical support to train operating and maintenance personnel. India, long dependent on British and U.S. aviation equipment, has become an unexpected repository for Soviet helicopters and turbo-prop transports.

#### Darkhorse in An-10

While the Iliushin turbo-prop transport probably has more appeal to new entrants into the airline field because of its resemblance to Western-type transports, we have long suspected that the An-10 and its later developments would eventually prove more attractive to those underdeveloped countries because of its ability to use grass and dirt fields, eliminating the requirement for expensive concrete runways. Technical development difficulties have retarded the introduction of this series even in Soviet civil and military transport fleets, but if its "bugs" are eliminated we may see other countries following the Indian example in buying advanced versions of this airplane.

The air transport area is a particularly attractive one for political penetration because it provides an excuse to deposit Soviet technicians in the countries concerned and also provides an opportunity to bring local nationals to the Soviet Union for technical training and exposure to its propaganda.

The U.S. has long operated a technical assistance program in aviation for other countries, and it has been successful in areas ranging from Afghanistan, Ethiopia, Pakistan and the Philippines to South America. However, in view of the new problems arising from Soviet activities in this field and because new areas of the world are developing an urgent need for modern air transport, it might be wise to re-evaluate this program with the idea of serving and expanding it to better fit these changing requirements.

This is an area in which the manufacturing and operational skills of the U.S. aircraft and air transport industry can make a tremendous contribution to the underdeveloped areas of the world. It will take some more imaginative thinking than has been displayed thus far to develop a more effective program in this area and meet the growing Soviet challenge.

—Robert Hote





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## NASA Will Create Man-in-Space Center

## Washington Roundup

One of the first changes in the National Aeronautics and Space Administration in coming weeks will be the creation of a Manned Space Flight Research Center, built around the Space Task Group which now handles the Mercury and Apollo projects.

This will be an attempt to give the group an increase in personnel strength and a freedom that will allow it to take better advantage of technological developments in planning manned space flight for a period 15 to 20 years in the future.

Space Task Group was to have become a part of the Golden Rule Flight Center near Washington once the Mercury project was essentially completed. The plan now is for it to become an independent center, building probably from 600 people to approximately 1,500, and remaining primarily a management group with few research facilities of its own. Location has not been settled. STG now is based at Langley Field, Va.

Recent visit of Pierre Salinger, President-elect John Kennedy's press secretary, to the Air Force Missile Test Center in Florida has given missile and space workers there considerable hope that Kennedy also will take a personal look at Cape Canaveral and its support area. President Eisenhower did not visit the Cape until Feb. 10 this year, despite frequent gulf and hunting trips to Thomasville, Ga., some 250 mi. away, and then he left a bad impression with many engineers by staying only three hours.

## Space Launch Notice

Fusion of an attempted space launching no longer will be the first notice to most of the public that the civilian space agency was trying, with its experiment.

After two years of officially refusing to discuss an impending shot until after lift-off or explosion—NASA now will release information about a week ahead of each attempt. It believes the experimental nature of space launching may get more emphasis in detailed preliminary stories, with the result that the public will become more aware of what organizing NASA Administrator Keith Glennan calls "the substantial inherent probability of failing to accomplish the full measure of launch-for results."

NASA's former policy—officially withholding information until the day before a shot, and then issuing press kits headed "hold fire launch"—was inherited from the Defense Department, where it didn't work either. The approach, intended to prevent a publicity "backlash" before a shot, was required by the Administration in the public relations panic that followed the spectacular explosion of a Vanguard test vehicle two months after Sputnik 1 was launched.

Central Intelligence Agency has been keeping a hot score on Soviet Russia's rocket diplomacy or "bulletic blackmail." On more than 40 occasions since 1946, Russia has threatened 15 different countries with destruction by rockets carrying nuclear warheads.

In spite of Russia's recent claim that it has reduced its defense budget "considerably" for next year, CIA believes that the Soviets are spending about the same dollar amount as the U. S. on military programs, but Russia will continue to build its war machine without being harassed by the cry for more consumer goods, and that this is reflected in its overcommitting engineers, typified by the rocket disaster.

## Foreign Activity Probe

Missile weapons development and U. S. investments in foreign defense firms and facilities are being investigated by the staff of the House Government Operations Subcommittee on Military Operations, headed by Rep. Cletis Holstad (D-Calif.). Hearings probably will be held early in the congressional session.

First report of the subcommittee, which pressed for reorganization of Space Technology Laboratories into a nonprofit company in 1959, will deal with Armstrong Corp. This is the company that was organized to help manage Air Force missile and space programs in line of an STL reorganization.

Staff report on the feasibility of integrated regulation, ownership and operation of various forms of transportation has been submitted to the Senate Commerce Committee, headed by Sen. Warren Magnuson (D-Wash.), after more than a year of preparation.

Objections by religious groups have forced USAF to look for another code name for Project Salam, its proposed satellite enterprise. Those who opposed the name said it should be reserved to religion, but it particularly affronted and outraged one when applied to a weapon system.

—Washington Staff





# Broader Planning Role Seen for Defense

By Paul Eastman

Washington—A senior aide for the Defense Department is showing energy and foreign policy planning is motivated by the background of his assistant to top Pentagon posts by President John F. Kennedy.

Defense officials shown last week include Eugene Zerkow, Washington attorney and former Air Force command secretary and Atomic Energy Commission, as its foreign secretary; John B. Connelley, Ft. Worth, Texas, former legislative assistant to Vice President Lyndon B. Johnson at Navy secretary, and Phil Nimitz, defense and foreign policy expert and former director, as assistant defense secretary for international security affairs.

Earlier, Kennedy had named Ronald Glynn, who also has had some experience in both the defense and foreign policy fields, deputy defense secretary (AW Dec. 26, p. 21).

In picking his top Defense aides, Kennedy appears to be deferring closely to the recommendations of his State Department aide (D-Wash.), chairman of the Senate Government Operations Subcommittee on National Policies, Mechanics of the Democratic National Committee.

Sen. John Stennis said "full and active participation of the Departments of State and Defense in the preparation of coherent political-military counsel for the President" to help him fulfill the obligation of his office.

Stennis is served in chairman of a

committee which prepared a report for Sen. Kennedy on national security problems. Nimitz, probably well known, is the most active role in coordinating defense and foreign policy planning. Glynn also served on the committee. Nimitz will be responsible for human resources and defense and foreign policy problems and responsible for direction of military security programs, and he will have responsibility for the department's relations with the National Security Council and the Operations Coordination Board. Announcing the appointment, Kennedy said Nimitz would play a key role in developing new disarmament policies.

Nimitz joined Eastman, Herd & Co., a New York accounting firm, in 1929 and became vice president before he left to operate his own financial consulting organization in 1936. In previous years, he has served with AIG as financial director, Coordinator of International Affairs, chief of staff and assistant branch, Bureau of Economic Warfare, director of foreign projects and director of Security Council Economic Administration and in special consultant to the War Department.

From 1944 to 1946, he was vice chairman of the U.S. Strategic Bombing Survey where he was assistant the Mobil for Mobil and in 1946 he was deputy director of the State Department Office of International Trade Policy. In 1948 and 1949, he was deputy to the assistant secretary of state for economic affairs, and in 1950 he became the director of the State

Department's policy planning staff. Nimitz was born in Berkeley, Mass. Jan. 15, 1907, and has a Harvard University graduate. He is president of the Foreign Service Educational Foundation and trustee of John Haystack University.

Zerkow has a long record of government service, starting in 1937 when he became attorney for the Securities and Exchange Commission from 1940 through 1944. He was an assistant in cabinet to the government and became of the Harvard Graduate School of Business Administration, attending to corporate affairs and later national defense. During this period, he also served as administrative head of the first postwar management course given at the Harvard Graduate School.

While a member of the Harvard faculty, Zerkow served as a special consultant to the commanding general of the Air Force in developing strategic controls. He was an instructor at the Army Air Force Command School at Harvard, which issued him about 1,800 Air Force officers, and he has served at various Air Force bases on special assignments for the Air Force during 1947.

In 1944 and 1945, Zerkow spent in the office of the Chief of Naval Operations as a lieutenant jg in connection with the Navy's strategic control program. In 1944, he became executive assistant to Stuart Sweeney, who was then administrator of the Strategic Policy Administration. When Sweeney became Assistant Secretary of War for Air in 1945, Zerkow became his special assistant and he was named military secretary of the Air Force until Sweeney became chief of staff in 1947. In 1947, Zerkow served on a committee established by Defense Secretary James Forrestal to write a unified joint military code for the various services.

From 1952 to 1954, he served as a member of the U.S. Atomic Energy Commission, and since then he has been in various energy consultant and attorney. Zerkow is chairman of the board of Nuclear Energy and Engineering Corp., a company in the field of nuclear chemistry, and a director of AMP Atomic of Canada, the atom energy subsidiary of American Motors and Ford. He is also the director of the U.S. Atomic Energy Commission in New York City Nov. 9, 1951 and received a Bachelor of Arts degree from Yale in 1953. He received his Bachelor of Law degree in 1937. Zerkow is associated with the law firm of Lane and Sweeney.

Connelley, who served in the Navy during World War II, specialized in

law and politics during most of his career. He was assistant to Vice President Dwight D. Eisenhower from 1955 to 1958 when Johnson was a member of Congress from Texas. In 1948, he became Johnson's national campaign manager and served as administrative assistant mostly after his election. Since then, he has served as national manager for Johnson in his unsuccessful bid for the Democratic presidential nomination. After the election, he worked for the Kennedy Johnson ticket.

## Very Veteran

The 43-year-old attorney entered the Navy as an ensign in 1934 and was assigned to the Atlantic Fleet, Naval Forces, Portsmouth. Later he was assigned to sea duty aboard the carrier Essex as a fighter aircraft director, and he served in the same capacity aboard the USS Bennington. He was awarded the Distinguished Service Star for service aboard the Essex and the Legion of Merit with a combat "V" for service on the Bennington.

When he left the service in 1938, he was considered as a lieutenant jg and helped organize and operate radio station KMET in Austin, Tex.

As a lawyer, Connelley represented the Petroleum & Gas of Texas and became secretary of the estate of Bill Randolph, now wealthy Mr. Worth oilman. He was born in Houston, Tex. and received his law degree from the University of Texas.

## Discoverer to Carry More Life Specimens

Vandalia, Ark.—Air Force Discoverer XIX satellite scheduled to be launched last night after Jan. 15 carrying advanced biological specimens for marine and space environmental effects after launch.

Discoverer XIX, large instrumented to determine basic earth-atmosphere is being launched for use in the Bell Telephone Laboratories, which will carry satellite payload, but transmitting power is at 7150 gals during the fifth day of its orbit around the earth. One additional day of data transmission was then provided, and Discoverer XIX will make it possible to cut the length of the orbit and cost saving its terminal reliability. Old orbit would be increased from the top of the orbit, where it is now, and probably placed in the line of the equator, depending on the state of the planet and also making its altitude.

General modification in the HUL-IM made with maximum modifications to its second payload of scientific and operational data.

HUL-IM project engineer J. B. Depolito reports that as difficulties were encountered in launching the

## Allison T63 Turbine Passes First Trial Run in HUL-IM Testbed

West, Tex.—First turbine modification test of the Allison T63 turbine engine, expected to play a significant role in the Army's light observation helicopter (LOOH) competition, has successfully passed its first "shakedown" test run, during ground test in a Bell HUL-IM helicopter.

If the HUL-IM testbed successfully passes its 20-hr. shakedown test, power plant will be actual flight tests which will be scheduled for 1961. Having pioneered first modification of the new turbine engine, Bell Helicopter Corp. engineers are anxious to be left to do it in an aircraft.

Two Bell HUL-IM helicopters were grounded after the test in the U.S. Navy, and accepted by the company to test the T63 for further tests.

The first test run, being tested, will be conducted in 1961. The engine portion of the engine evaluation program. The second is scheduled to be delivered to West Division of General Motors Corp. for engine installation.

Not yet having completed installation of the powerplant to its existing helicopter and also for shipment, but the engine rate for the test, now possible to see as powering the Army's

light observation helicopter (AW Sept. 5 p. 10).

It is one of the conditions for the test and considers the opportunity to collect additional data on engine performance with the powerplant of this stage of the general engine. Engineers also consider the test of getting the T63 into an engine on a helicopter and also the engine.

Engineers also had a checkered record of the LOOH engine. Indications are that Bell engineers feel that installation of the T63 would be most beneficial if the powerplant is installed during the test at the top for better views, and also clearing the area for a job in the field.

Indications are that Bell engineers would make it possible to cut the length of the orbit and cost saving its terminal reliability. Old orbit would be increased from the top of the orbit, where it is now, and probably placed in the line of the equator, depending on the state of the planet and also making its altitude.

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## Turbine Indications

Engineers indicate that with the T63 installed the HUL-IM will have a service ceiling of 10,000 ft. at an altitude of 17,100 ft. for the 1961 T63 with gross weight of the test aircraft being 7,500 lb. The fuel load of the T63-powered HUL-IM is calculated at 1,500 lb. in an amount 1,120 lb. for the test program.

Although Bell officials do not comment on the possibility of being the T63 in the present test, probably because delivery dates and problems of production engine are still not firm, indications are that the engine will be installed in the test.

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## Army Cancels Republic SD-4 Drone

Army canceled the Republic SD-4 Shadow observation reconnaissance drone project last week, indicating development will continue on the Fairchild Republic F733 which has longer endurance. Both are powered by the Pratt & Whitney FT33 turbojet engine.

The Fairchild project will undergo a further Speed Corps technical review this month that will include testing. Since the SD-4 is now the only candidate in its mission category and has been making good progress, Fairchild is optimistic about its future.

Republic will lose the \$5 million not spent on the project in fiscal 1961 funds plus the potential production value the program was lost. The SD-4 was the main design project of Republic's Missile Division, and 110 production models will be built at the end of a five-year contract. The SD-4 is now the only candidate in its mission category and has been making good progress, Fairchild is optimistic about its future.

Since the SD-4 has been built and first flight has been scheduled for this month, Army does not plan to fly either one. To date, 534 orders have been placed. Army gave its money for the contract, meaning that the SD-4 system, which has been made in two groups and is being built in other drone programs. Army-General is developing the proposed SD-2 observation drone, which also is being built.

Both the Fairchild and Republic drone are at Ft. Huachuca, Ariz., where the Fairchild drone made its first flight last May. In the first of five flights, the SD-2 remained airborne 11 hr. One of the first was a launch failure, and its another recovery parachute failed though the flight was successful otherwise.



Recovered MR-1 Mercury capsule is shown being lowered onto the deck of the USS Valley Forge by Marine Corp. HH-44 (Sierra 5.05) helicopter following pickup approximately 250 air downrange from Cape Canaveral, Fla.



## Recovered Mercury Capsule Received Only Minor Damage

Only apparent damage received by Mercury capsule which made flight Dec. 19 (AW Dec. 26, p. 16) was broken outer layer of three-layer heat-insulation glass in nose port (right center, below). Above left, capsule is positioned on Army amphibious vehicle. First on Atlas 5 and 11 is United States on Mercury capsule (above right) is believed but NASA said that was not significant because the point has a low Marquage temperature. Breaks in heat seal (below) are dry cracks stress and not result of heating.



# Japanese Rearmament Plans Face Delays

Tokyo-Japanese Self Defense Agency—the military administration government—under the MacArthur new constitution is worried that its rearmament plans may be further delayed by Washington's new anti-dollar policies.

Agency officials in Osaka, however, believe Japan's efforts to create modern defense forces against the growing power of Communist China have been held up by opposition of the neutralist Socialist Party. But building of a respectable air, navy, and land tactical group—totalling about 140,000 men—has slowly moved ahead in the past five years with considerable U.S. aid.

Most of the U.S. aid has been in the form of equipment—great aid—and the Japanese forces that, increasingly, the Japanese have been looking to the U.S. to supply part of the financing to get the Japanese defense industry back on its feet.

The project to re-equip the Japanese air arm with F-104s, for example, will be jointly financed by the Japanese and the U.S. The total cost of this initial three-year wing will cost \$307 million. About 575 million of this will be met by the Japanese and the U.S. will be supplying 10 U.S.-built F-104H fighters and 179 engines for the first 10 to 15 planes under the program. Then Tokaijima's Mitsubishi Co. is to produce the remaining 170 to 168 engines.

Although America "guaranteed" shipping companies for tanks, small arms, artillery, communications, land ships, and training programs—will total an estimated \$39 million in fiscal 1967—Japanese A-1, officials of the Self Defense Agency said. This figure does not include the \$73 million "grant" used for the F-104 program to be processed over a three-year period beginning last year.

The U.S. has asked the Finance Ministry for a total of about \$515 million for fiscal 1967 in budget recommendations, says Tetsuo Ito, its director. But the SDA and other observers expect this figure to be increased to at least \$550 million in previous years to about 18% of the total national budget. Although American planning has materialized that the Japanese would be willing to pick up a share share of their own defense costs (they now run about 21 and 15% of the gross national income) the pattern of a fixed percentage of the national budget must be significantly in the government's view all countries agree to have because the accepted principle on which Japanese conservative politicians are working.

Observers are divided as to the question of what will happen if the U.S. because of the gold drive—new orders to

cut its contribution to Japanese defense. The Japanese government of Prime Minister Hiroto Ikeda once took this month with an absolute majority over the opposition Socialist Party. But it failed to pass the two-thirds majority which would be necessary to amend the constitution and strike out the "no war" clause. Further, most of the Socialist Party gained an additional 21 seats—largely at the expense of the anti-Communist minority right-wing Social Democratic Party. Without the Socialist Party the reformist liberal forces increased their strength.

All this seems to add up to a very serious policy on defense, in other words, for the Ikeda cabinet in the months ahead. Ikeda is known as a tough politician and a stubborn advocate of a pro-Western orientation for Japanese foreign policy. But it is not likely that he will want an all-out battle with the Socialists over the defense budget in the opening session of the Diet (parliament).

Japanese observers in Tokyo point out that there is no reason, per se, for the American contribution to the Japanese build-up to be increased. Most of the U.S. contribution has been in U.S. made equipment.

## Industrial Potential

But, increasingly, Japanese defense officials and important sections of industry—such as the steel—have tried to "sell" the defense program to the Diet and the public on the basis of its great long-term potential for Japanese industry. For example, American offshore technology, for example, for South West Asia, Korea, and Taiwan has assumed to be a big part of the total production of the Japanese automobile industry, and has provided it to research and expand its facilities to lower unit costs and meet the demands of the Japanese car market.

One project which the SDA and U.S. officials have been planning with is the development of the present car, various versions in Japan. Japanese automobiles of the U.S. Fifth Air Force based in Japan and the Self Defense Force (which have been asked to provide their own vehicles as a planned force) are considered and cannot now of low unit costs with a unitary cost of only 500 to 1500 yen.

Japan's Nippon Electric Co. an affiliate of International Telephone and Telegraph, has made some major advances in over-the-horizon radar. It would be easier to sell the development of the Japanese system to the Diet if NEDC made the equipment with a cash contribution from the U.S.,

rather than the Japanese buying new equipment from the U.S. Also the Japanese believe their industry is now prepared to meet the demands of the American military aid program in South East Asia, as at least part of it. With Japanese defense industries set up through contributions from the U.S. to most cases of the third country is going for equipment under the U.S. Military Aid Program, the Japanese expect it would be easier to take the Diet and buy the same equipment for the SDA.

One project that may be dropped if there is any American withdrawal is an anti-aircraft helicopter system in which the Japanese were planning to start construction in fiscal 1967. This year's budget proposal contains a small item covering initial planning for the carrier.

The Finance Ministry has already let it be known that it opposes the project because the SDA has not come up with an overall program of expansion. An expansion program for expansion was dropped after the Kishi government fell in mid-summer during the Socialist-sponsored demonstrations against the U.S.-Japan Security Pact. The SDA said that they will return to submit a new plan until they see what the nature of the new Diet will be.

Original plans for the carrier were for a 30,000-ton displacement weight ship which could be completed by January 1967. Two nuclear submarines.

Japanese Ministry's foreign investment program last week approved financing agreements between Mitsubishi Heavy Industries, Kawasaki, Ltd., and United Aircraft to produce domestically 80 30-ton Sikorsky S-64s. Agreements include payment of \$500,000 monthly. Mitsubishi will build the S-64s starting in mid-1967. The S-64s will be manufactured but the rest will be domestically manufactured except for some equipment. Estimated delivery program cost is about \$600,000 per unit.

If the SDA's budget is severely cut, the program to give Japan a battalion of Nike Ajax units may be scrapped. (Which have been asked to provide their own vehicles as a planned force) are considered and cannot now of low unit costs with a unitary cost of only 500 to 1500 yen.

One of the biggest costs of the SDA is the high cost of personnel expenditures in the total budget of the force. Wages now account for more than 60% of the SDA's total expenditures. Recently, however, the government has a wage, which is considered a very high figure



**Soviet Ilyushin Il-14 Shown Over Laos**

Russian Ilyushin Il-14 transport with eight engines in down flying area. Last, about 30 mi north of Vientiane, a C-130 was seen on the ground at Luang Prabang, the airport on Dec. 11. It apparently was used to evacuate wounded and supplies to the ground. The aircraft was seen from the ground.

in Japan, in order to compete against the higher wages now being offered by American contractors in the Japanese market. The foreign market (not yet opened) in the new Japanese government expects to take up this problem when he visits Washington next year early this year.

Under the unapproved Japanese American security treaty signed last summer, the U.S. gave the Japanese authorities (under support of American forces in Japan) and requested to approximately \$175 million annually. American was that Japan would pick up a larger share of its own defense costs in exchange.

The Japanese Foreign Ministry is worried to postpone the deal. It is rumored in Tokyo that because of the high degree of efficiency and technology in the Japanese shipbuilding industry. In the 1966 program (which) last year, the U.S. cost the 100,000.

One plan set forth by the Japan Civilian Aid, a Japanese of defense industry companies, is that at least a portion of the Government's American & Related to Occupied Areas program be devoted to the defense buildup. Thereafter, the Japanese cost the

## Solar Flares Raise Atmospheric Density

Washington—Solar flares apparently affect the earth's atmosphere by increasing its density, according to a report developed by the National Aeronautics and Space Administration as a result of a shift in the Echo II orbit during the intense solar storm Nov. 12. Extensively tested by the system, it was doubled during the life of the storm and increased the orbital period for the 100-ft. satellite by two seconds each day. Echo passes through the outer Van Allen radiation belt, and NASA believes solar particles hit outer the belt heated the atmosphere in that area and increased its density.

Echo was launched Aug. 13 and after 12 days is orbiting accurately at the U.S. Britain and West Germany demand that the orbit be affected by solar particles. Atmospheric density has changed the orbit of the sphere from its initial 915-1,690 mi perigee and apogee to the present altitudes of 616-1,136 mi.



## AIR TRANSPORT

# FAA Plans to Require DME on Transports

**Mandatory rule will be proposed soon for airlines; first installation expected to be on jet aircraft.**

By Philip J. Klaus

Washington—Distance measuring equipment would become a mandatory aviation aid for transport type aircraft under a Civil Air Regulation revision which will soon be proposed by the Federal Aviation Agency.

The FAA says it has been under consideration for some months, the value of such equipment was brought into sharp focus by the recent major collision at a United Air Lines DC-8 and a TWA Constellation in the New York area (AW Dec. 26, p. 27). FAA is expected to propose that first installation of distance measuring equipment (DME) take place on jet aircraft, with equipping of piston engine transports to follow.

The Air Transport Association, which several years ago expressed the view that there was no operational requirement for DME and that its use should be on a voluntary basis, is not expected to contest the upcoming FAA action.

American, Pan American, Trans World and Continental Airlines are among the U.S. carriers which had earlier, and started to use, DME. United Air Lines, which has been equipping the two available DME equipment, made by Collins Radio and International Telephone and Telegraph Corp., has decided to outfit its entire fleet, starting with its jets.

Airline support for the proposed FAA mandatory DME action results in just one pending indication that the recent major collision may have increased demand for the use of the DC-8's two VOR receivers (see p. 27).

On the FAA part, only one operating VOR, it is thought that he might have accidentally turned to the Strawberry communication station, at a frequency of 114.7 mc, instead of the 113.7 mc of the Solberg station operating at 114.2 mc, to fix his position relative to the Princeton holding point, which is established by the intersection of the 123 deg radial with the Victor 123. The 123 deg radial from the Strawberry station intersects Victor 123 just above the collision in believed to have occurred. If this error had occurred, the pilot would have thought he was approaching the Princeton when in fact he was 10 mi beyond the point DC-8's VOR receiver and its timing head, both recovered from the crash, may provide evidence to support or refute the pilot's error.

As an aircraft equipped with DME, the pilot gets a direct reading of his position along the vector from the VOR

station along the vector information even if it had been equipped with an airborne DME. However, it could have been in distance from one of these nearby communication Victor stations at Solberg, Solberg or Strawberry.

The mandatory requirement for DME coupled with the recent accident is also expected to spur action and FAA action in potential cockpit displays. Airlines, particularly those with a high number of jets, are expected to display instrumentations, and until FAA developed traffic control procedures to enable aircraft equipped with ground stations to benefit from the system.

There are several reasons why the FAA has not moved earlier to make DME mandatory. About the time that the former Civil Aeronautics Administration and its successor, the FAA, issued ground stations, and airborne equipment were becoming available, the latter conflict between DME and other traffic data. When this was resolved, with the decision to adopt a combination of VOR and Tacan (Victor), FAA had to buy and install a new ground station equipment, and the FAA had to be equipped with DME, but it was delayed.

First airborne DME can be purchased by JTT, which had developed Tacan and built the first airborne traffic data. American Airlines was the first to order and install the new equipment, but it subsequently had to pull them out of service because of reliability problems. These jets require new new been delayed up, according to both FAA and JTT, and American is now re-evaluating equipment to its jet fleet.

Collins Radio, the second DME supplier, has had prototype equipment evaluation by the airlines, including American, Boeing, Delta, Pan American, TWA and United. The company expects to be in production in March, and the FAA has already received a Production order for FET is about 30 jet aircraft, but it could be accelerated.

FAA was reluctant to make DME mandatory until there were at least two suppliers of reliable airborne equipment and until there were sufficient ground stations commissioned. At present, FAA has approximately 250 Victor stations commissioned.

The airline industry has been reluctant to use an DME on a voluntary basis for the same reasons, plus several additional ones. The JTT equipment actually constructed did not meet the

FAA distance measuring equipment technical standard under (TSC) equipment for transport type aircraft. Both FAA and ATA held that until the requirements were met, the equipment would not be usable if FAA should find it necessary to increase the number of Victor stations and had to resort to closed upholding to do so.

The FAA granted JTT and its DME products a two-year waiver on the TSC, with the understanding that the company would redesign the set to meet specific phase operation requirements. This JTT has done, a spokesman told Aviation Week, and the design change will be introduced in the production line a year after the 1950th acquisition. A Collins spokesman says its DME meets that specific phase operation requirements and requires no waiver.

Initially, the FAA looked unfavorably on the use of substitute tubes in the Collins DME but first view has softened in the result of reliability evidence that these tubes in Collins phase type sets the reliability required. The JTT equipment does not use substitute tubes.

An JTT spokesman reports that his company has delayed approximately 150 DMEs to date, and he predicts that the number 150. These figures include about 10 for American Airlines, 30 for TWA, 17 for Pan American, and 30 sold to General for installation on its 300 propeller jets. The FAA has about 50 sets, all of them for ground stations and corporate aircraft.

The JTT distance measuring equipment sells for approximately \$15,000, the Collins equipment for approximately \$6,000.

## Subana Flights Normal Despite Belgian Strike

Brussels—Belgian World Air Lines reported last week that its flights were operating without interruption despite the eight-day general strike which paralyzed much of the surface transport facilities within the country.

In response to the strike order issued by the Socialist Party, its general planned cooperation by the Christian-Social (Catholic) government, an estimated 10% of Subana's 8,800 employees walked off the job. Most, however, were airline pilots, and their absence did not affect normal operations. Airport buses and truck vans still moving regularly between Brussels and the airport.

A Subana spokesman said his last week that the strike should not have any major effect on the airline's operations, but it is in progress and schedules are concerned unless it becomes prolonged and does serious damage to the Belgian economy in general.

## Trunkline Profits Hit 11-yr. Low Because of Transition to Jets

Washington—Domestic trunkline carriers lost profits of \$60 million last of approximately \$4 million by the Air Transport Association, reached the lowest level since 1949 as jet transition increased costs faster than record revenue.

This decade profit picture, due to the \$55 million profit forecast by Aviation Week (AW Nov. 21, p. 16), is in sharp contrast to the all-time high of \$140 million reported last year by the industry, during the year. At 34%, it represents a low rate of return when compared with the 10.5% return on invested capital recently announced by the Civil Aeronautics Board. The average rate has been 6.2% over the past five years.

During the year, gross revenues climbed 14% as a result of dependence on jet aircraft, trading and other services. The industry's total revenues rose 10% from \$1.7 billion to \$1.9 billion. Profit margins on sales for the industry in 1960 was 21%, one year with 54% in 1959 and 31% in 1958.

ATA President Stuart C. Tipton reported the breakdown since last year with comparative figures of transportation in 1960. He said "The industry's total revenues rose 10% from \$1.7 billion to \$1.9 billion. Profit margins on sales for the industry in 1960 was 21%, one year with 54% in 1959 and 31% in 1958."

### More Revenue Corridor

The 12 domestic trunkline carriers added 457 million passengers in 1960, compared with 447 million in 1959. Load factors were handled 5.6 million during the year compared with 5.2 million the year before, and helicopter pilots showed an increase from \$60,000 to \$90,000. International and overseas airlines lost about 4.7 million to 5.3 million passengers. Airline carriers from \$20,000 to \$30,000 to \$20,000 to \$30,000. ATA estimates are based on reported figures for those carriers with the fourth quarter for comparison.

According to the ATA estimate, close to half the total expenses of the domestic airline industry are attributable to wages and employee benefits. As of June 30, the industry was employing 158,657, a net increase of 3,175 over 1959. Annual payroll projections for 1960 are \$1.1 billion, a \$214 million increase over 1959. Average salary per employee was \$6,957. Commercial Department studies show that average net earnings for full time employees in all industries was \$4,775 in 1959.

If 8 domestic airlines had merged, the cost of 451 billion-passenger aircraft by first month. Of the total 273 were helicopter transports and 237 were turbojet-powered. The order for delivery between 1961 and 1965 was 23 turbojets and 237 helicopters and 100 piston transports. Total fleet for the domestic industry stood at 1,800 aircraft at all times of the year.

The ATA report found that 73,657 of the 1960 aircraft were piston-powered. It is noted that in 1950 75% of the transportation on airlines was on U.S. flag carriers but that by 1958 this figure had declined to 54.7%.

### Tot-Mile Increases

In domestic terminals, jets have cut fares—Ally and Trans-Canada the largest increases during 1960. The two companies handled 154 million passengers last year during the year compared with 127 million in 1959. The jets, helicopter transports earned total revenues of \$44.5 million for carrying mail, including both passenger and mail, and first-class fares. The two companies had 154 million passengers last year during the year compared with 127 million in 1959. The jets, helicopter transports earned total revenues of \$44.5 million for carrying mail, including both passenger and mail, and first-class fares. The two companies had 154 million passengers last year during the year compared with 127 million in 1959.

ATA also reported as estimated 844 jet carriers over 1959 in the volume of air flight handled by the domestic airline industry. The entire U.S. air industry handled 704 million ton-miles of cargo and freight in 1960. Of this amount, 119 million ton-miles were for 774 million ton-miles, international and overseas carriers. The 197 million ton-miles and all cargo airlines had 125 million ton-miles.

Air express ton-miles rose 9% above last year's volume. The industry flew an estimated 79 million express ton-miles in 1960, compared with 56 million during 1959. Express revenues for the 12 domestic trunkline totaled \$1.7 billion compared with \$1.6 billion last year. Express and freight airlines total \$96 million compared with \$56 million in 1959.





ROYAL Air Maroc Conquester prepares for landing in camp at Toulose, having stopped there en route to Paris flight.

## Air Maroc Bases Jet Service on One Plane

By Robert E. Fencil

Casablanca, Morocco—Rapidly turned maintenance system gives aircraft reliability in providing Royal Air Maroc, Morocco's state-controlled air carrier, to offer round trip jet service six days a week between Casablanca and Paris with a single Conquester.

Scheduling has been set without a single flight overhauls since service began last May 20. Daily delay, amounting to one hour, was due to late arrival of Conquester just past colored from Paris. Company's single Conquester will continue to be flown on tight scheduling until next Spring when the carrier's second Conquester III will be delivered and put into service.

By late 1971, Royal Air Maroc's single Conquester had logged 1,193 hr with only a serious mechanical problem, Jean Delac, the carrier's technical director, told Aviation Week technicians of the Conquester's performance, more notable than normal handling of the company's four L-747 Conquesters.

Delac says that seven main days of maintenance are needed for each Conquester flight hour. This is one hour more than maintenance that the company has established for a single Conquester flight hour. Royal Air Maroc spends three man-hours for each DC-1 flight hour.

### Carrier's Fleet

Company has two DC-1s, four L-747 Conquesters and the single Conquester. A second Conquester III is the only one still en route at present.

To keep its Conquester on a steady round trip loop, the company laid down the following operations and maintenance scheduling.

Based at its Casablanca headquarters, Royal Air Maroc's Conquester begins its

workweek on Wednesday. Flight 512 leaves Casablanca at 5:16 p.m., stops at Rabat, Morocco's capital, and then goes nonstop to Paris. The Conquester returns to Casablanca at 7:41 a.m.—the time occurring after having over an hour and a half in Paris.

Since home flight returns is repeated during the rest of the day. On the Casablanca Paris run, only one working flight is made weekly. On the Paris-Casablanca weekly run, two nonstop flights are made. On other days, stops are made at Rabat, or Bordeaux, or Toulouse. Also, on Thursday and Sunday, the Casablanca-Paris flight is extended to Frankfurt, returning the same day. In every case, the company's Conquester leaves Casablanca at the morning and in back on the longer trip nights.

On consecutive days of Conquester's re-scheduling, six hours daily at 15 flight hours each—each when it lands at 7:30 a.m. Monday night at Casablanca. Company's maintenance interval takes but a day and a half—until Wednesday at 1:10 p.m.—to prepare the aircraft for another six days of work. This is usually enough time to

handle routine weekly inspection checks. Real maintenance test comes about every fifth week when the aircraft's 100 hr inspection falls due. Royal Air Maroc handles all 100 hr inspection. When 1,000 hr Conquester inspection comes roughly once yearly—the work will be done by Air France in Paris.

### Maintenance Routine

Shortly after the company's Conquester lands at Casablanca on Monday night for a 100 hr inspection, a special "pre-inspection crew" immediately prepares the aircraft for the type of inspection required. This work takes from 3-5 hr. Actual maintenance work goes under way Tuesday morning and continues 10 hr through that day. Work is then picked up again Wednesday morning at 7 a.m. and is programmed to be completed by noon.

The aircraft is then rolled out on the apron for engine, wing and propeller work for the island schedule.

To date the company has kept to its schedule through the 100 hr inspection. Some inspection required time-consuming labor, such as complete de-



ONE of the carrier's two DC-1s is shown at Casablanca preparing for takeoff to Agadir, Morocco. Conquester III is in background in Royal Air Maroc flight to Algiers.



CASABLANCA is down being prepared at Casablanca for Toulouse-Paris flight. It will return the next night.

menting of cabin configuration. At times, almost none of a co-cabinity as they are left over to the next work. De-cabin is broken up the aircraft is made usually on Wednesday morning. When 100 hr inspection, involving 6-8 hr of work, is completed within 15 hr by 37 mechanics.

Company officials say that reliability of the Conquester engine and Rolls Royce turbojets have made this operation possible. The aircraft's two Rolls Royce Avon turbojets recently were overhauled, as required, at 1,100 hr. Overhaul is being done at Rolls Royce in England. Engines were at first running condition when repaired, according to Delac. He claims time between overhauls could be to 2,000 hr on the Conquester Avon, without risk. Reproduction has recently been used to 1,200 hr.

Royal Air Maroc has five Avon turbojets for its single Conquester and plans to buy seven—first operating and then in stock, one in two Conquester fleet.

Officials of the carrier appear to be well satisfied with these single Conquester on the moment as well as the technical side. Conquester load factor of 75% is even somewhat higher than the same projected. Seventy-five load factor runs to about 60%, with a load factor at 65% on international runs.

Company operates its Conquester with 20 first class seats (two and two) and 55 tourist (two and three). Flight crew consists of two pilots and a flight engineer. Captain also handles the radio when Conquester pilots are French. In fact, all the carrier's flight and cabin personnel—except for 12 Moroccan through-out Europe, mostly French. The company employs 26 pilots, 17 flight engineers, 12 radio operators and 21 hostesses.

Royal Air Maroc currently is operating a five-line fleet structure:

• **Paris class.** Charged only as Conquester flights and one two Conquester flights to Marseille and Nice.

• **Tourist class.** Charged on Conquester flights only. Both first and tourist Conquester fares are aligned on Air France Conquester service to Casablanca.

• **Economy class.** Charged on most of the company's Conquesters, all of which are configured for 54 seats.

• **Emergency class, night.** Charged on Conquester night flights to France.

• **40" class.** Charged on company's two DC-1s operating within Morocco and to Algeria points.

### Five Strains

This delicate fleet structure meets its special requirements, the company feels. Thus it isn't anxious to join IATA although it follows IATA rates as closely as possible on its international runs. Thus, here, the

• **Casablanca-Paris-Frankfurt.** This main trunk line was extended to Frankfurt last May with delivery of carrier's first Conquester. En route stops are Rabat, Bordeaux and Toulouse. Royal Conquester and Constellation operations are used.

• **Casablanca-Geneva.** Weekly Conquester flights with stops at Bordeaux and Rabat.

• **Casablanca-Nice-Lyon.** En route stops are Rabat, Oujda, Morocco, and Marseille. Not all these Conquester flights are through services, some terminating at Marseille and Nice. A second Conquester will go on this route next spring.

• **Morocco-Algeria.** Constellation and DC-1 flights linking Moroccan cities with the cities of Oran and Algiers.

• **Casablanca-Dublin.** Weekly nonstop Constellation service.

• **Morocco-Spain.** Three-fourth Conquester flights, leave Casablanca to Madrid. In addition to this main route, the company also operates three flights linking Moroccan Mediterranean cities via Tangier with Gibraltar and Malaga, Spain.

All at Royal Air Maroc's main base in France, as well as its southern run to

Dublin, are operated under a pool agreement with Air France. Carrier also pools with the Spanish base, then and Avon, on routes to Spain, and with Gibraltar Airways on its Tangier-Gibraltar run.

With exception of the Frankfurt addition last May, Royal Air Maroc has been operating its present international network for several years. Its main effort to date has been to add Morocco with France. About 80% of the last's traffic in France, 15% foreign and only 5% Moroccan.

Basically the carrier's business has improved since the carrier's independent start in 1957. Many Frenchmen while returning to France, nonetheless continue to improve business interests in the former French possessions. Traffic is also seasonal, with summer vacation periods provoking highest flight frequencies between Morocco and France.

Future note points of Royal Air Maroc's main routes present traffic dependence on the French-Moroccan link. While annual to Milan is the only one more definitely in the weeks for next year, the carrier is also studying routes to England, Belgium and Scandinavia. It is likely that the company will order a third Conquester if it decides to open those routes.

Royal Air Maroc earned 114,161 francs in 1970 and flew 15,500 commercial hours. This year company will have loaded about 118,000 passengers, of which 20% will be Conquester seats. Royal Air Maroc's traffic has been increasing at an annual rate of 3-5% and company officials expect this rate to continue in the immediate future.

Royal Air Maroc traditionally has yielded profits for its owners. For the year ending June 30, company's profit was 51,821,000 francs. Company officials expect the current year, ending next June, will turn in a higher profit since this will be the first full year of Conquester operations.

Only data on the carrier's operations





## AIRLINE OBSERVER

► British reports of future flight tests of an "ogee" wing on the Fokker F27-200 aircraft have set off speculation that industry is trying, in circumvent present limitations restricting supersonic transport work solely to wind-tunnel tests. Ogee wings, currently favored by British Aircraft Corp. as the basis of design studies for a supersonic aircraft configuration, get its name from the S-shaped leading-edge of the wing.

► Airline hull liability insurance rates will not necessarily be forced upward by the TWA-Delta collision, but underwriters are feeling the reaction. Some publicly the high rates that accompanied the jet disasters and resist rate increases support for reductions. However, if investigation leads underwriters to believe there is a fundamental problem at the root of the two disasters—such as a deterioration of the adequacy of the New York traffic control system as a whole, given a series of insurance rates is likely. Otherwise, underwriters may feel the collision was one of the inevitabilities allowed for in pricing rates. No single year's experience is used in setting insurance rates, so the collision alone would not necessarily be a governing factor in a rate change.

► Siberian Helicopters World Airlines has expressed interest in leasing several Sikorsky S-61s, a twin turbo-shaft helicopter capable of carrying 26 passengers (AWT Dec. 10, p. 41). Carboair is long-haul passenger traffic resulting from helicopters in the Congo have so stressed the carrier's finances that aircraft purchases of the \$120,000 helicopter is not considered feasible. Sikorsky takes a dim view of leasing the S-61s, but hasn't ruled out such a program as a future possibility.

► Eastern Air Lines will spend about \$35 million this year on new ground facilities. Some \$18 million is slated for new jet hangars, turbine engine overhaul plant and improvement of general facilities at Miami. Maintenance facilities, including new hangars at Boston, Atlanta and Norfolk, will account for \$13 million. Eastern will cover costs of airport terminal improvements throughout system and are at refurbished ticket and service train offices in 38 cities.

► Special Russian emergency teams of Komsomol (Young Communist League) activists have found that America's advertising managers aren't getting across to the public. Results of a poll taken by the group showed that many Moscow citizens had only a vague idea of the services offered by the Soviet airline. Investigation disclosed that people at one Moscow station were taking the train to Helsinki in central Helsinki before they were conscious of an international airline service. Most train passengers had no idea of airline fares or the amount of baggage that can be carried free by air. Often thought planes seldom flew during the late fall and winter, and many were unaware that buses operate regularly to all Moscow airports.

► International Air Transport Assn. forecasts that a total of 118 million passengers will be carried by the world's domestic and international airlines in 1964. International Civil Aviation Organization has estimated that the world's airlines carried 108 million passengers in 1960, a 16% increase over the 93 million handled in 1959.

► Federal Aviation Agency has removed the 7,600 hr safe life limit on the Fairchild F-27's rotor wing section (AWT Dec. 24, p. 42), thus saving local repair costs operating the twin helicopter transport about \$30,000 per wing per accident in three facts. Declared a "hot spot" instead of a "safe life" component by FAA, the rotor wing section no longer need be scrapped at the 7,600 hr mark, but can be used indefinitely if periodic inspections are performed.

► Delta Air Lines has scrapped scheduled overhaul plans for the General Electric CF6B51 turbojet powering its Boeing 747-200. Delta took that aircraft from flight between overhauls of the CF6B51 can be accelerated so rapidly under Federal Aviation Agency's failure rate formula (AWT May 2, p. 34), that scheduled overhaul, at TBO levels near 4,800 hr, would impose an economic hardship. The airline may reconsider the scheduled overhaul concept proposed by GE when stage has determined the safe life limit of rotation of the engine's components.

## SHORTLINES

► Alaska Airlines is adopting a fairly rare plan, choosing members of a family over 12 years of age to travel at two-thirds of the regular fare when one member over the full fare. The plan was scheduled to go into effect Jan. 1, and continues until Apr. 30, subject to Civil Aeronautics Board approval.

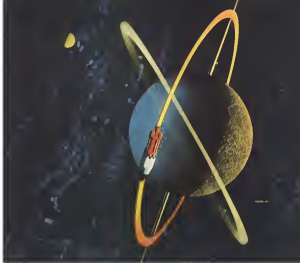
► Continental Airlines has asked Civil Aeronautics Board permission to cut air freight rates up to 27% as cargo saving during the daylight hours from Los Angeles to Chicago in order to encourage shippers to use the daytime daylight flight between the two cities. Shippers would have to get shipments to Continental's facilities or its cargo agent in Los Angeles between 2 a.m. and noon. Cargo would be scheduled on one of the airline's four daylight flights to Chicago, which has a total of 90,000 lb capacity.

► Eastern Air Lines will add Semotes/Bendless, Fla., to its system Jan. 15 as a result of the recent Civil Aeronautics Board decision on the Semotes/Bendless Service Investigation. Eastern will offer seven daily flights to the dual city airport.

► Northeast Airlines' decline for starting service at Baltimore's Friendship International Airport, endorsed by the Civil Aeronautics Board in the Washington-Baltimore Adequacy of Service Investigation, has been extended to Feb. 25. The Board originally stated the effective date of its ruling until Jan. 16. Northeast selected for a further year to get its Convair 440 turboprops on the route to Florida from Baltimore and obtain station facilities at Friendship International Airport.

► North Central Airlines carried more than one million passengers in 1963, becoming the first local service airline to reach the million-passenger mark. Based in Minneapolis-St. Paul, North Central last month increased its service by about 30% with the addition of 15 new Madison routes. It serves 10 midwestern cities with a present total mileage of about 4,300.

► Red Airline of Brazil has been awarded traffic rights from Rio de Janeiro to New York via Lima, Peru, by the Brazilian Ministry of Aeronautics. The airline currently serves the U.S. at Miami and Los Angeles. Red plans to reorganize its fleet, with all its international routes early in the summer using Convair 440 turboprop transports scheduled for delivery in late spring.



Two-powerful Agusta turbines in orbit — www.bell.com

## THE ENGINE WITH THE FUTURE

### Reliability... Efficiency... Flexibility.

In space, these words have a million-dollar meaning.

Vast sums of money and vital scientific data ride on these hallmarks of Bell Aerospace's rocket engine for Lockheed's Agusta satellite, second stage of the Ariane Discoverer series.

The Agusta engine, designed with space in mind long before space became a household word, has fulfilled its every promise and has placed more tons of useful payload into orbit than any other power plant. Its operational reliability is backed by six years of development and 3,000 test firings.

This Bell engine now has re-entry capability — the first in the nation. This means that its satellite can change orbit in space without the penalty of extra engines. Presently in production, this engine also is adaptable to new fuels and new assignments and, consequently, is programmed for important military and peaceful space ventures of the future.

Agusta's engine is typical of the exciting projects in Bell's rocket propulsion center. It is part of the dynamic new approach of a company that's keeping ahead in rocketry, aerospace and space techniques. These skills serve all government agencies. Engineers and scientists anxious for a new kind of personal challenge can find it at Bell.



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**VICKERS  
VANGUARD**



# British Scout Satellite in Development

By John Tunstall

London—Construction and testing of prototype equipment for the British instrumented Scout satellite is now under way following successful agreement between the British National Committee on Space Research and National Aeronautics and Space Administration in Washington on the satellite and payload details of the proposed experimental program.

According to an American White Paper, new techniques and tools of space research have been developed in the U. S. for the future program which will permit the construction with studies of electron temperatures and densities, ion energy distribution and mass spectrum in the magnetosphere.

The program will also include a major study of the cosmic ray energy spectrum of a type which has not been previously attempted.

## Distinguishing Features

One of the most distinguishing features of the British instrumentation is the provision of discriminating circuits within the satellite largely for the first time—which enable the probe current voltage curves to be analyzed and to detect before telescoping. Notable detail of the current rate measurements now enables the use of a particle counter employing the Chernikov light emission effect.

But in Prof. J. Sorens who heads one of the three participating research groups put it, "The program will not be going anywhere new and much of the

comprehensive results will be largely an extension."

The satellite, 5.5 ft., will be a cylinder two feet in diameter with two cylindrical rods. Instrument load will weigh about 30 lb. and the weight of the satellite structure, antennas and solar power supplies, all of which will be supplied by the United States, total 100 lb.

The tape recorder in the satellite will respond to ground command stations, one of which will be located at the U. K. radio research station at Slough.

Landing at the Scout four-stage rocket is expected from Wallops Island, Va., within the next 12 months.

The addition of the groups has been confined to those sections who have already obtained experience in spaceborne equipment with Skylark rockets and in the plasma physics field. The experimental program is in fact an extension of the Wisconsin (Australia) rocket program studies, using improved techniques and equipment.

Cosmic ray studies will be undertaken in a group under Prof. Elliot of Imperial College, London. The group hopes to establish the way in which the cosmic ray energy spectrum changes with solar activity and the major novelty of the groups approach has to do with a system of recording measurements of the spectrum from the satellite with a series of simultaneous measurements from aircraft during at 50,000 ft. altitudes.

It is desirable coordination between the two measurements of cosmic rays, it is

believed that future measurements of the nature of the proton spectrum can be deduced from aircraft measurements alone.

The proton spectrum—which is the number of particles of a given velocity—can be found by observing the proton spectrum coming with latitude, these variations being due to the effects of the earth's magnetic field. Only the magnetic particles can get through near the poles. In comparing the spectrum measured at different latitudes the number of particles in a particular energy band will be deduced.

## Chernikov Detector

Prof. Elliot told American White Paper that the group has developed a "potentially dense" way of looking at the heavy cosmic particles beyond orbit. It is based on a Chernikov detector and counter which Elliot believes has not previously been used in a satellite. The instrument consists of a four-inch plastic scintillator and a photomultiplier. Heavy particles moving with enough energy that of light pass through the plastic at speeds in excess of the speed of light in the material. In the process of slowing down in the plastic, energy release in the form of light causes scintillation—the Chernikov effect.

The light is carried within the scintillator and presented to the photomultiplier.

Flashes from the heavy particles are much more powerful than those emitted by the smaller particles and the counter can be gated so that only the heavy particles will be counted.

This ability to discriminate in favor of the heavy particles is the main advantage of the detector over more conventional Geiger and scintillation counters. Scintillations have tended to confuse previous measurements, and Elliot, because the denser the particle, the bigger the pulse. "The Chernikov detector is blind to the unwanted noise."

Because no equipment like the detector has yet flown in a satellite it is to test the design in a Black Knight flying before it is connected to the satellite.

Long-term objective of the Imperial College group is the relation of the changes in the proton spectrum to the changes in the strength and configuration of the interplanetary magnetic field.

The ionospheric studies will be undertaken by two groups from University College, London, under Dr. R. K. F. Wood, and the University of Birmingham under Prof. Sorens. One of the main ionospheric experiments by these two groups will be the measurement of electron density from the difference in time delay between radio waves and radio waves in an ionospheric probe and

spacecraft" at of experiments. The results will be available.

Another group of experiments by University College aims to measure both the ion energy spectrum and the ion mass spectrum.

At the same time the University College group will look at the ultraviolet and X radiation from the sun in order to correlate variations from the sun with the properties of the ionosphere.

The method of studying the local free electron population density is space adopted by the Birmingham group does not depend on conventional Langmuir probe techniques, but on the change in dielectric constant which the particles produce in the medium within which they are present.

This method of electron density measurement was pioneered by Birmingham University and first proved in Skylark from Western Union tests in 1959. Although the U. S. has now taken up the method, Sorens said the system is to be employed in the Scout satellite in a far more accurate development of the original system. Sorens would not say that the group had standardized its method, but he said, "We have been doing it longest, and we have most experience of the method."

## Density Measurement

Density is expressed by capacitance, the effect of the plasma between the plates is a dielectric being proportional to electron density. To obtain a value, the capacitance between the plates and surrounding the plates of the capacitor will be " swept clear of electrons" every four seconds by burning the electron, voltage and the measuring system automatically reset.

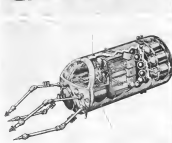
The apparatus consists of two strong electrodes of a few square inches each placed a few inches apart and connected to a radio frequency source of 100 mc.

Under the influence of the alternating field oscillation with the plates the electrons oscillate between the plates in resonance with the field. The oscillation of the charged particles within the electric field thereby induces small alternating (induction) current to flow in the electrodes.

The alternating induced current is amplified electronically, within the satellite, and represented as a d.c. voltage which is proportional to the electron density.

Several factors determine the frequency of the exciting source, Sorens explained. For reasons of data collection the frequency must be considerably above that of the critical radio wave propagation frequency. It is also related to collision probability.

The frequency also affects the ratio of the induced current to the natural current flowing in the electrodes. At 10 mc. the induced current flow is of the



## Martin Studies SLOMAR Space Vehicle Designs

As France's Wright Air Development Division has reported contractors totaling \$100,000 to study the need and design for a space laboratory, and under SLOMAR (V) action which would involve spacecraft launch in the next 15 years. Martin Douglas and Natick will make the study under \$140,000 contracts. Lockheed and Convair have 100 months and General Electric's contract is scheduled. Martin Douglas says, "Shortly before launch would carry out tests in space perfect in conditions with which we cannot do in earth. Martin Douglas says the probe would be used to simulate a space station in orbit. The companies were selected for SLOMAR study several months ago (ENR Oct 24 p. 21) and negotiations were completed in mid-December. Future studies include orbital conditions, environmental simulation, structural and other tests, vehicle attitude control, space payload transfer, spaceborne scientific techniques for measurement, data reduction, and observation and control procedures. The program is a study of pilot space during launch and recovery. Studies will consider use of nuclear propulsion for upper stage and auxiliary power.

One of the capacitance plate counter. Most gravity frequencies would result in the electron-induced current being very small compared with the natural current.

This capacitance technique has already been compared with a development of the Langmuir probe technique which is used by the University College group. The cross-check was carried out under laboratory conditions simulating ionospheric temperatures and pressures and gave precise agreement, according to Dr. Wood.

The capacitance technique appears to be both slightly less accurate and more complicated but in both will be difficult to detect by ionospheric conditions the behavior of the two experiments in orbit will ultimately decide the most reliable approach.

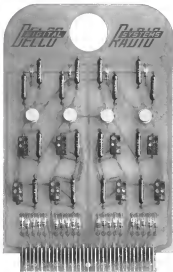
Validity of the capacitance method has already been proved in a Black Knight flying in which the cone rose acted as an probe and the rest of the rocket is the other.

The electrode beam of the capacitance equipment is restricted during



Second Saturn Booster Assembly Fixture

Second Saturn booster assembly fixture under completion the work at the Marshall Space Flight Center, as the first known under to be built tested under its final stages of assembly. Results engineering and testing the booster stage, assembly operations, the final program before is completed with carrying out to serve as the rocket's transportation trailer



## DIGITAL MODULES

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Which package fits into your design? Packaged either way, Delco Radio Digital Modules meet or exceed all MIL-8-32511D (ASG) environmental requirements. Containing logic tests on these computer circuits have passed first and one-half million transistor hours without a failure. The modules perform all the standard logic functions and come in many basic types and variations.

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launching. As fitted in the Skylab, the complete instrumentation electronics package weighed 14 lb with batteries. Scarcely all of the equipment will qualify electron devices down to a few thousand per pulse counter to be measured and is therefore suitable for satellites of high's receiver orbits in a deep pocket.

The University College group will use highly developed forms of the Langmuir probe technique in its non-spherical measurements. These are originally devised by the college's physics department for plasma investigations in discharge tubes. Using complex and powerful electronic methods, the technique enables the determination of heavy negative ions in the probe current to be distinguished from that of much lighter electrons, in the probe current-voltage curve.

The equipment will be used to determine electron temperature, and the same technique will be used in an analysis of the ion energy spectrum.

The determination of the ion mass spectrum in this technique is based on the fact that the energy, with which an ion impacts a surface, is approximately half the product of the ion mass and the velocity of the satellite square.

### Radiation Measurement

Another major requirement of this group will be the monitoring of the fluxes of Lunar Alpha particles and soft X-Rays, using equipments which have already been used in the Skylab, lunar.

Dr. Reed emphasized the data gathering features of the ion mass and ion electron temperature measuring equipment in Soviet to be the differential analysis of the probe current voltage curve about the satellite and the use of a subtle differential technique, which was not true dependent.

Using the usual Langmuir probe technique, electron temperature is derived directly from the ratio of the first and second derivatives of the (IV) current voltage curve of the probe electrode. Previous workers have attempted to analyze the curve for double gradient disturbances on the ground from the current data teletransmitted from the vehicle. This is not possible, Reed says, due to the noise signal ratio. Furthermore, it is affected by variations in the vehicle potential which tend to swamp the effects it is desired to measure.

Reed's modification of the Langmuir probe technique enables the IV probe curve to be analyzed on board, and its second derivative which contains much of the energy information teletransmitted directly.

The computing technique which has not been widely used is based on the fact that if two voltages of different



**Device Proposed to Orient Satellite**

satellite-orientation device proposed by General Instruments design specialist Lawrence J. Koenig consists of a 100-ft boom to which could be attached a flat, and four other boom-shaping tubes which could be attached. The tubes, made of thin dielectric rods, glass fiber laminate or boron fiber ropes, to model the boom becomes tubular when excited by electric current. Design is based on theory that provides a stronger pull on the end of a satellite closer to a planet, while centrifugal force keeps opposite end of elongated satellite pointed away from the planet.

Frequency are applied to the probe, then, max, giving a modulated wave, the degree of modulation being proportional to the second derivative of the IV curve. This follows from the fact that if the modulated wave is passed through an amplifier with automatic volume control, the rate takes the ratio of the first and second derivatives.

The first derivative gives the amplitude of the main wave and the second derivative gives the modulation. Hence the ratio is proportional to the percentage depth of the modulation, and hence, to electron temperature.

The ion mass spectrum from which the mass spectrum can be obtained directly is obtained by an identical analysis of a second cylindrical probe IV curve, the probe being beamed on the open end of the vehicle. The energy

spectrum is contained in the value of the second derivative, the ratio of the two derivatives again being proportional to the ion temperature.

Plotting the ratio of the second derivative against voltage gives the ion energy spectrum. Because the vehicle has hypersonic velocities, kinetic energy of the ions makes the speed of the ions it follows that the ion energy (with due correction for satellite charge) is approximately half the product of the ion mass and the vehicle velocity and so the mass spectrum can be derived directly from the energy spectrum.

As the computation method does not involve differentiation with respect to time it avoids the introduction of complications due to often time dependent parameters such as the vehicle motion.

## Discoverer XIX Gathering Midas Data

Los Angeles—Discoverer XIX, scheduled to launch with an extended orbit from Vandenberg AFB on Dec. 28, has some scientific objectives but primarily is gathering data for the Midas earth sensing program.

The satellite carries infrared equipment similar to that planned for Midas satellites. Unlike earlier flights in the Discoverer program, there will be no effort to measure a data capsule from the 2,100 ft. Apogee 8 capsule. All data from Discoverer XIX will be transmitted to ground stations just as it would from an operational military warning satellite. The information about the satellite will measure the light background infrared emitted and reflected from the earth and its atmosphere. This experiment was planned to continue until the batteries about the 25 ft. long, Apogee 8 capsule about four days after launch.

Period of the Discoverer XIX orbit is 91 min. Its range is about 600 mi and its perigee is 120 mi. The satellite will be located by the Air Force at Vandenberg AFB, Ft. Viterb, Naval Weapons Center, Redwood, Alaska Naval Station, N. H., and Keesler Pt., Hawaii. Telemetry readout will be provided by these stations and the Minuteman ship USNS Redfield located downrange from Vandenberg.

Airplane and radio commands to the Apogee 8 propulsion system will be transmitted from the Ft. Meigs station. All tracking and telemetry data will be transmitted from the station to the USAF Satellite Test Center at Santa Rita, Calif., where USAF has been using the Discoverer program to build the technical and management skills that will be needed to orbit such launching and operating Midas and Sunstar satellites.

First developmental models of Midas and Sunstar will be launched from rural missile fields at Ft. Apogee, the Plum Brook Range base immediately north of Vandenberg. The status of Midas vehicles will be planned to enable USAP to observe all the earth with about 10 satellites in polar orbits.

## Plum Brook Reactor To Operate in March

Washington—Nuclear fuel will be loaded in the Plum Brook reactor at Oak Ridge as the National Aeronautics and Space Administration begins to shape its program to develop nuclear-powered concepts for nuclear space propulsion system.

Atomic Energy Commission heating loaded gaseous NAA, a permanent permit to operate the ORR as a water-cooled

test reactor after hearings completed Dec. 16 and physicians now are preparing to begin deuterium tests within 90 days.

In developments associated with operation of the reactor, NAA's Lewis Research Center recently avoided a conflict for a nine-power meeting in sector and plans to select a contractor with next view for a nine-power handling device.

Louisiana's General Division has a \$449,000 contract to build a two-power reactor which will be used to conduct control rods and check out initial feasibility of potential nuclear rocket concepts. The Lockheed test reactor will be used to measure neutron and gamma properties and neutron effects of components before they are exposed to the environment of the 60 sec. reactor.

Reported for progress has been issued for an endowment propulsion system to test components to expose parts in the reactor as that performance characteristics can be measured. Data for the unit, consisting of propellant, oxidizer, and gas turbine engine and power supply, are due at Lewis Jan. 24.

Among companies, to be listed in the Plum Brook, include air chemical materials, pumps, seals, steeling, and other power gear and working fluid.

## Military Supply Center Uses Computer System

Washington—New data processing systems which perform the role of an electronic catalog for the world's largest shipping lot has gone into operation here at the Armed Forces Supply Support Center (AFSSC).

The new AFSSC facility will keep a running up-to-the-minute inventory of more than 15 million items used by the armed services which will be stored in 216 miles of magnetic tape. The new equipment, which can handle 100,000 individual supply management actions per day, is built around an IBM/Model Business Machines Corp. IBM 705 III large scale computer and three smaller IBM 1401 models, one of which is now installed. Other two are slated for operation by next July.

Since all the management supply services which the new system can provide quickly upon request include:

- List of items, location and amount of items inventory (all army) all over the world in the field or in stock.
- Will announce transactions, deposits, movements and present goods access to available supplies.
- List of items by manufacturer's part number, name, corresponding field stock number. This is expected to be particularly useful in processing spare parts for new weapon systems and

engines which are standard parts of the in the inventory. For other weapons or equipment, details to date indicate that up to 30% of new weapon parts already exist in the field or in stock.

The new AFSSC data processing system replaces an earlier paper-based system installed in December, 1956. The initial system which was parallel data processing, identification data for about 60% of the items in the inventory, global data on weapons requirements by two-thirds and reduced data required to handle weapons by more than half, the system is now fully operational. The system will handle one year ago growth of about 100,000 items.

Use of the early system increased to nearly that it now can handle operating 24 hr. per day, seven days per week, making it difficult to find time for maintenance requests. The new IBM equipment is expected to handle the present work load in a 16 hr. day, 24 hr. per week, period providing surplus time for processing new management control data.

The AFSSC facility serves 90 government military, technical, including the Air Force, Navy, Coast Guard, National Aeronautics and Space Administration, Central Services Administration and National Security Agency in addition to the military services. The AFSSC facility is linked to 15 communications centers by means of special dial telephone data transmission equipment which enables the centers to communicate directly with the information base. IBM 1401 computers. The 1401 system checks incoming queries and data for validity and arranges them into a format which can be used by the larger IBM 705 III.

## System Designed to Purify Air Inside Space Capsule

Hydrex Standard has achieved one more in a 100-hr. test of a system designed to remove carbon dioxide from the air inside space capsules. The system, under development for 24 years, purifies air through carbon that can trap fine microscopic crystals of sodium aluminum silicate. These crystals have pores 15 to 20 billionths of an inch in diameter which absorb the carbon dioxide molecules.

In the recent tests, two capsules were closed inside an airtight chamber and carbon dioxide was fed into the chamber to simulate the respiratory output of a third person. Air quality inside the CO<sub>2</sub> collected by the chamber was measured by a vacuum pump which removed the carbon of space. In this test, more than 100 lb. of carbon dioxide, weighing about 35 lb., were consumed during the 100-hr. test.



Modeling of a complete mobile unit support base (MUSB), part of which is shown above, was made by Boeing Airplane Co. for a recent development engineering mission held at Seattle, Wash. Service, maintenance and supply will be performed out on the Minuteman base from the two-week "crusade" they will make over the nation's 100,000 acres of modified. First MUSB will be constructed soon after AFSSC, Utah.

## Minuteman Mobile Unit Support Base Model Shown

Minuteman mobile unit support base (MUSB), part of which is shown above, was made by Boeing Airplane Co. for a recent development engineering mission held at Seattle, Wash. Service, maintenance and supply will be performed out on the Minuteman base from the two-week "crusade" they will make over the nation's 100,000 acres of modified. First MUSB will be constructed soon after AFSSC, Utah.





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The most proven large ballistic missiles, the Atlas (left) and Redstone (right) will launch America's Astronauts. Many of the engines of both are by Rocketdyne.

## AERONAUTICAL ENGINEERING



NUCLEAR-POWERED attack aircraft considered by the Air Force in 1955 is shown above. This Lockheed design was to have been powered by an Pratt & Whitney indirect cycle (IC) nuclear turbojet engines operating from two circulating fuel reactors. This aircraft would have had *supersonic dash capability* when turbine power was interrupted by *atomic demand fuel*.

## Special Report:

## Gains Promise Supersonic Nuclear Flight

This is the third of a series of articles on the various applications of nuclear power to aircraft and space vehicles.

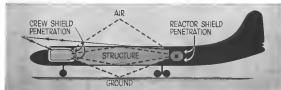
a nuclear aircraft at supersonic speeds, powered by reactors based on current technology.

### Supersonic Flight

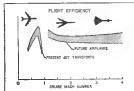
These advances may make nuclear-powered supersonic flight possible, without waiting for the development of re-

series capable of operating at higher temperatures and producing more power for a given engine weight than current series technology permits.

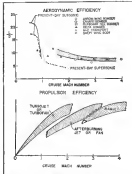
With their greatest foe a sophisticated weapons system, these strident and eager advocates hope to accelerate action within the Defense Dept.



**CREW** compartment on a nuclear-powered aircraft must be completely enclosed by its shield to protect the crew from direct radiation from reaction and from radiation scattered by the air, the ground and the aircraft structure.



THOSE charts illustrate how improvements in aerodynamic and propulsive efficiency during the last few years have brought the expensive nuclear-powered aircraft closer to reality. Aerodynamic efficiency at supersonic speeds has doubled and turbojet thrust today has widened the band of propulsive efficiencies which are possible above Mach 1. Total thrust has been the right thing; efficiency of modern aerospace aircraft is very close to that of efficient jet transports and bombers. A supersonic nuclear aircraft, therefore, will require a much lower power engine than it is suggested that we will need. The engine, however, will be a big thing, too. The engine, too, has been doubled from a figure of 10,000 to about eight during the past few years, a performance improvement which adds, the RTO sources people



ment that nuclear-powered aircraft based on current technology must be subsonic and therefore would have limited utility, *sic* etc. They are:

- **Improved lift/drop ratios** In the past four years, the lift/drop ratios for supermassive cranes has been doubled from a range of four to about eight. This can

hardware implemented inside the  $\delta$ 70 package, and it also serves to cut the processor's estimated power consumption by reducing unneeded instructions.

- **Improved second-generation** distill for engine technology. Development of multiple engines has resulted in an

The very high propellant efficiency of these engines makes it possible to increase the thrust developed by one

Total effect of these two design inputs has been to lower the thrust-to-

weight into regard for superior flight to the point where the aircraft must be developed by General Electric and Pratt & Whitney Aircraft.

### Concise Textbook

project, the Convair NK.2 subsonic  
sketch scheduled for first flight in  
1965, is essentially the same design  
with which the company won the

Canal competition in March, 1999.  
The Canal aircraft was to provide the  
COLLATION WIRE, January 2, 1991

As Force with continuing software alert, make launching and low-level penetration ability over unsecured users with target network from...

The NX 2 is to serve as a testbed for nuclear engines, induction reactors or such systems. Baku and around her

diag. procedures and all phases of machine aircraft operation in detailed spec-

Scenarios can be written for a weapons system. Basic specifications for the experimental NN2 cell for a spread of Mach 0.8 to 0.9 at 35,000 ft., lower

of about 140 ft., span of approximately 150 ft., gross weight in the neighborhood of 500,000 lb., or about 3.5 ton, and a massive conference for it.

Such engine systems as the engines of

[illegible]

**OPERATIONAL** life of new cruise systems in the collision avoidance of a nuclear-powered submarine attack aircraft is shown above. The aircraft would have a divided task in that all equipment outside of the crew should avoid a substantial collision danger. Originally, most of the systems shown would not function properly for over 180 h in a similar environment. But 10 years of development has assured them life to figure shown.

# TI IN MILITARY ELECTRONIC SYSTEMS



A partial listing of equipment, designed, developed and manufactured by TI, now operational in the Armed Forces includes:

1. F-16, F-15, F-4 Phantom II, and other aircraft in use by the U.S. Navy, U.S. Air Force, and U.S. Marine Corps.
2. AN/APG-68 radar for the F-16, F-15, and F-4 Phantom II.
3. AN/APG-70 radar for the F-16, F-15, and F-4 Phantom II.
4. AN/APG-88 radar for the F-16, F-15, and F-4 Phantom II.
5. AN/APG-90 radar for the F-16, F-15, and F-4 Phantom II.
6. AN/APG-92 radar for the F-16, F-15, and F-4 Phantom II.
7. AN/APG-94 radar for the F-16, F-15, and F-4 Phantom II.
8. AN/APG-96 radar for the F-16, F-15, and F-4 Phantom II.
9. AN/APG-98 radar for the F-16, F-15, and F-4 Phantom II.
10. AN/APG-100 radar for the F-16, F-15, and F-4 Phantom II.
11. AN/APG-102 radar for the F-16, F-15, and F-4 Phantom II.
12. AN/APG-104 radar for the F-16, F-15, and F-4 Phantom II.
13. AN/APG-106 radar for the F-16, F-15, and F-4 Phantom II.
14. AN/APG-108 radar for the F-16, F-15, and F-4 Phantom II.
15. AN/APG-110 radar for the F-16, F-15, and F-4 Phantom II.
16. AN/APG-112 radar for the F-16, F-15, and F-4 Phantom II.
17. AN/APG-114 radar for the F-16, F-15, and F-4 Phantom II.
18. AN/APG-116 radar for the F-16, F-15, and F-4 Phantom II.
19. AN/APG-118 radar for the F-16, F-15, and F-4 Phantom II.
20. AN/APG-120 radar for the F-16, F-15, and F-4 Phantom II.

**TEXAS INSTRUMENTS INCORPORATED**  
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 DALLAS 5, TEXAS

APPARATUS DIVISION

to have a life expectancy to 1,000 hr. The NX-2 can be expected to have a payload capacity of 50,000 lb. as better if performance currently predicted for high-speed nuclear engines can be achieved. There is every indication that these predictions can be expected to be better. The nuclear test work on the direct cycle engine has been encouraging, producing a reactor core temperature of 1,600°F using metal fuel elements. It is possible to achieve much higher temperatures with ceramic fuel elements if their oxidation and radiation problems can be overcome.

Early estimates of nuclear aircraft performance by the National Advisory Committee for Aeronautics showed that nuclear engine temperatures of 1,600°F would be necessary to achieve an aircraft in the NX-2 weight class if the engine engine thrust-to-weight ratio were attained. Recent data on engine thrust-to-weight ratios are still scarce, even after a year in the performance of any nuclear aircraft and then also in the data on the performance of the engine. It is expected from follow-on aircraft.

## NX-2 Thrust-to-Weight Ratio

In broad terms, however, the overall aircraft thrust-to-weight ratio is expected on the NX-2 aircraft is very good, by comparison to the performance of any nuclear aircraft and then also in the data on the performance of the engine. It is expected from follow-on aircraft.

On the basis of this information, the NX-2 will have an aircraft thrust-to-weight ratio that is better than the F-16 at takeoff. This comparison shows that the NX-2 is not only feasible, as a new concept in all technical aviation.

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Ethiopian Air Force F-86

Ethiopian Air Force F-86 shown in use of TI technology in Ethiopia. The aircraft is a second-hand F-86, the first of a series of aircraft to be purchased by Ethiopia. The aircraft is a second-hand F-86, the first of a series of aircraft to be purchased by Ethiopia.

As a result of the extensive work on this problem, it is now believed that there is much less than a 10% increase in any preliminary design shield weight estimate.

This system is based by extensive experimental data.

No further requirements of a major nature are expected in shield design. Subsequent studies have been made of every conceivable shielding material and nuclear reaction rate. It is now believed that there is much less than a 10% increase in any preliminary design shield weight estimate.

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Mexican Air Force Havilland DH-100 Vampire

Mexican Air Force Havilland DH-100 Vampire. The aircraft is a second-hand DH-100, the first of a series of aircraft to be purchased by Mexico. The aircraft is a second-hand DH-100, the first of a series of aircraft to be purchased by Mexico.

level at his command to keep shield weight down. The objective of shielding aircraft has been to maximize the understanding of these low risks so they may be applied to the best advantage.

They are:

- **Disposition of shield mass.** Decisions must be made whether the shield weight should be concentrated around the cockpit, around the crew and equipment which must be protected, or distributed in all of these areas.

- **Selection of materials.** Materials must be used which will absorb the maximum possible radiation except for a given weight of shield.

- **Construction methods.** Several different materials are usually required in lightweight shields and they can be used as a homogeneous mixture or in separate layers.

- **Geometry.** Radiation pattern from an aircraft reactor is determined by the fuel structure, engine and equipment which are near the reactor by the usual distribution of the shielding mass and by structural member geometry. Direction also plays a role because radiation is scattered by the air during flight and by the air and the ground during takeoff and landing. It is impos-

sible to save weight at the heaviest portion of the shield core by placing it in the path of the heaviest radiation.

Most effective means of reducing shield weight is through distribution. There are two general classifications of shields as determined by the distribution of their mass. They are:

- **Unit shields,** in which the entire shield mass is concentrated around the reactor. With this design, the radiation on the outside of the shield is related to a safe level for humans.

The crew and the passengers of an aircraft using the unit shield could come aboard it with during flight, and the aircraft could be struck on the ground and upon landing. Drawbacks of the unit shield is that it is extremely large and heavy, although its size and weight can be reduced and below those of unit shields currently used with ground-based reactors. With current technology, unit shields probably will be practical only for aircraft with nuclear cycle engines and very low power requirements. Early warning aircraft and high speed transports using turbo-propellers fit this category. If the unit shield design proved to be such an early warning aircraft design work will be required to make this work.

- **Divided shields,** in which part of the shield mass is placed around the reactor and part around the crew compartment. Shield weight can be lowered dramatically by using a divided shield rather than a unit shield. Divided shielding will be used on the NA-4 and undoubtedly will be needed on any high performance attack aircraft that might incorporate a later date. Most favorable distribution appears to be about half of the shield weight around the reactor and half around the crew compartment.

Divided shielding means that there will be two fairly different radiation levels on the outside, a very low one inside the crew compartment and a very high one outside. This is acceptable because humans are about a thousand times more susceptible to radiation than most materials in aircraft structure and equipment.

Problems for divided shielding are confining the crew to a relatively small, cramped compartment for several days at a time. Likewise, using conventional engine landing maintenance of engines and equipment, exposing most of the aircraft structure and its contents to high energy radiation which deeply robs them useful life. Although

there are several problems, they are outweighed by the obvious light weight of the divided shield.

In the near future there is a need to explain the processes by which neutrons can penetrate and absorb the radiation energy from a nuclear reactor. The many discovery, radiation, however, does not properly reflect the difficulty of the research which led to the present advanced state of shield technology and materials. Detailed study of the science and interpretation between neutron energy and the atoms in the shields has given extremely complicated, and it has involved endless experiments and computer work.

## Two Types

Basically, there are two types of radiations from a fission reactor which must be shielded by protect human and aircraft equipment. They are neutrons and gamma rays. The latter processes by which they are slowed down and absorbed.

- **Neutrons are slowed down** through a series of elastic or inelastic collisions with atomic nuclei. The lighter the nuclei that the neutrons strike, the slower they lose low gas collisions. The slowing down or moderating process is vital to neutron shielding because neutrons themselves are absorbed into the core of the atom in the shield even readily when they have low energy. Paradoxically, this means that the best materials for neutron shielding have a high proportion of atoms with a low atomic number and light nuclei. Hydrogen is best in this respect, and water is also material that contains a high percentage of hydrogen is a good neutron shield.

- **Gamma rays lose their strength** through collisions with electrons. These lose, a gamma ray shield must have a maximum number of electrons which means the dense elements with high atomic numbers most effective. Lead, iron, tungsten and tantalum are good gamma shields.

Shield materials cannot be selected on the basis of their nuclear properties alone because about 90% of the energy released in a fission reactor is thermal. Shields are subjected to very high heat loads and must be cooled. They also must be strong and have low weight in some designs so their great weight is not undue structural.

To satisfy all of these considerations, the important factors in the selection of shield materials include modest properties, weight per cubic foot of material, strength at high temperatures, cooling required, and thermal stability and resistance to oxidation at high temperatures.

Heavy metal hydrides should be as good shielding material except for one major fault. These substances will stop both gamma rays and neutrons off



Tunisian Air Force Saab 37

First seen at 15 knots VED Sea tower and known aircraft parked by the Tunisian ground. The aircraft is shown in a landing position.

month because they contain more electrons as well as hydrogen nuclei. Theoretically, that thermal stability is poor, they absorb readily in an air high temperatures and it has been difficult to apply an efficient protective coating to them.

## New Materials Developed

New materials developed for shielding are now possible from plastics which have large percentages of light nuclei and which the proper thermal and strength characteristics.

Lightweight shields are usually constructed of several materials each of which is the optimum for stopping a slowing radiation of a given energy level. For example, some light materials will slow a neutron fast neutron very efficiently, while those have an atomic capacity for absorbing and stopping low neutrons. Other light shielding materials have exactly the opposite properties and will absorb slow neutrons

well, but are poor moderators. Each type of best general shielding also will perform best in stopping gamma of a particular energy level.

It is possible to use homogeneous shields in which the necessary materials are mixed together evenly. This has not proved to be the lighter construction method in most cases, however, and it has been more efficient to use several materials arranged in separate layers or dials.

Several shield designs can be based from the nuclear standpoint because each layer can be specifically chosen to attenuate the secondary radiation emitted from the inner shield as well as a portion of the radiation from the reactor. Control of the secondary radiation, released in gamma rays and neutron losses caused among the atoms of the shield material, is as important as control of the primary radiation from the reactor. It is possible with engineer shield design for the ac-



Sabena Caravelle VI to Be Delivered in January

First Sabena Caravelle VI is a four-engine jet of Sabena's Tunisian branch. Sabena originally ordered two Caravelle VIs, then ordered six more to be delivered in January the last two in June. The Caravelle VI will have 100 seats, 25 200 lb. 6 passengers (total at 12,200 lb. three). These engines require maximum takeoff weight to 120,000 lb. from 99,200 lb. for the Caravelle VI, which is provided by Sabena's 25 Aves (total at about 11,000 lb. three).

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### First Flight-Line Photo of Sikorsky HSS-2s

First flightline picture of the Sikorski H53-2 two-turbine ASW helicopter now in production for U.S. Navy emphasizes the large, boxy but still necessary to contain all the avionic gear built in the primary mission. Streamlined exhaust profiles featuring two-bore main and two-bore lower, have been flown as part of company/Navy flight test and performance proof program. Gross weight of the H53-2 is 17,100 lb, powerplant is a pair of General Electric T340 turboshafts, each rated at 2,275 shp each.

necessary addition to segments within types of primary radiation and various, the induction has striking the outer layers of the shield.

Lancing also can produce weight benefits of the heavy gunner, as pointers can be placed close to the struts as they rotate to keep in a position.

Most experts believe that general and shield research has reached the point of diminishing returns and that little new information of importance will be gathered on shield materials, laminated construction and the distribution of shield mass. The only significant weight reductions are expected through detailed work on specific vehicle designs in which the effects of shield placement and the overall structure are considered simultaneously.

### Use of Geometry

Most important and elementary use of geometry in aircraft design is to help the crew and sensitive mechanical systems maintain distance from the reactor. Radiation rays tend to travel linearly, so they spread apart quickly as they leave a radiation source such as a reactor. As a result, a piece of equipment with a cross-sectional area of one square foot would receive far greater radiation dose if it were located five feet from a reactor than if it were located one foot away.

The paper substantiated statement to describe the effect is that radiation dose at every number of particles.

ing the varying of radiations per unit distance. There is a least incentive to its effective use in aircraft. Structural weight of the feeding increases as the distance between the cross shield and the reactor shield is increased. Finally, a point is reached where less weight is added by increasing shield weight than by lengthening the feedings to allow a given reduction in radiation dose for the crew.

The dimensions coincide with a four-leg, freemove cage and a machine power similar to that of the NN2, the main source of practical distance between the view compartment and the reaction area between 180 and 145 lb.

Shallow shirdding is another technique. It consists simply of placing wires near the machine to provide a zone of induced induction extending toward the coil compartment or other area containing induction sources, such as a magnet. Shallow shirdding can be provided by increasing the thickness of the armor shield in certain spots or by placing heavy structural components near the resistor so they block off part of the induction in a specific direction.

It is possible, for example, to locate the wing spars on a supporting structure just ahead of a fuselage-mounted engine so they will serve as a structure shield for the crew compartment. Heavy fittings and bracing are added to wings, the structure shield in the wing aircraft structure are also shield for use as structure shields to protect the crew and aircraft systems.

### Shadow Shield Regiment

The draft diagram must attach one more requirement if he is to use shadow shielding and aircraft geometry effectively. He must be able to predict the radiation level at any point of interest by tracing the paths of neutrons and gamma rays until they are well clear of the aircraft. While radiation meters in aircraft have it is scattered and its direction altered as it endures in between

### Helicopter Winched to Destroyer Deck Landing

Kennex Aircraft Corp. has completed work on an test of a window heating system for de-iced/bled windows, using a remote-controlled IR (infrared) and a safety pilot flying below 4000 ft. The system involves one of 400 IR constant torque drive on a cable stretched below the helicopter's cabin of ground control, to assist the constant electric control of the deck. Cable is dropped about 50 ft above the deck, raised through a watch block over the center of the landing pad and then rises up to the constant torque drive which maintains a steady pull. Cable strength is about 10,000 lb., as required to 20. Kennex has made the system part of its Stepdown II three helicopter project. In U.S. Navy's DASH program (AW No. 13), it is 20.

ball type collisions within the shock aircraft structure, air molecules and ground. It is possible through these collisions to completely remove the detection of a significant percentage of the miniature particles. Therefore, the maximum level at each point on the aircraft will vary with the detection order and technology.

### Crew Area Protection

If the cirs compass is considered as an example, the heaviest portion of the radiation follows a straight line from the source shield. Some of it is reflected by single columns with the structure, due to the total the process of the aircraft in landing or taking off. Another portion of the radiation participates in multiple scattering events. Result of the scattering is that additional energy strikes the cirs compass from all directions and it must be shielded on the sides and in front as well as at the rear.

If the crew is to be allowed decelerate forward rather than using per straps, the windshield in the compartment must be efficient shock shields. The rear section of the crew compartment will require the thickest shield to stop the heavy struc-

low radiation as well as scattered particles. The energy of the scattered particles striking the sides, top, bottom and front of the cow compartment is relatively low because radiation strength decreases as the scattering angle increases.

Design and weight of the test, and post-test soft disposal upon how accurately it is possible to predict scattering. A rare number of microscopic and microtomographic studies have been made of the scattering and absorption cross-sections of the various materials, and the place where scattering occurs in the material, the size and the shape of the scattering centers, the probability of these two events taking place in the various media and the probable direction of the radiation particles, will take after scattering.

Originally, there was enough doubt about these laboratory experiments and computer studies that it was felt not feasible to use them as the sole basis for an aircraft structural design. To eliminate these uncertainties and establish a positive check on its shell design methods, the ONP group conducted a special flight

A modified Canine B 35 was used in this program. It had a master wheel

could be operated over a fairly wide power range, and the reactor's shield arrangement could be varied externally. The crew was carried in a heavily shielded compartment in the rear.

Radiation measurements were made in flight and during ground runs so that ground scatter could be differentiated from ice and structural scatter. It was also possible to isolate the effects of air scatter from structural radiation scatter by flying the aircraft at high altitudes where atmospheric density was so low that air scatter was negligible.

### Stochastic Tests

Static tests concerning air and ground scatter were made with a large facility at Oak Ridge National Laboratory. This facility allowed test masses and cone components to be suspended with tensioning apparatuses distal and at various heights above the ground. The trestles are high enough to allow the ground scatter to be completely characterized as only air scatter will remain. It would also be possible with this test facility to suspend simple straight structural components between the trestles and the cone component and get structural surface displacements.

Good correlations of data from the



## First Middle East Airlines Comet 4C

First of two Coast KC-130s transports for Midlife Fast Airlines, powered by four Rolls-Royce Arco engines, made its first flight last month. Aircraft is scheduled to commence regular service for Midlife Fast this month. Other three Coasts as well will be delivered in the spring.



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stream ground studies and the flight program showed that it would be possible to use the data for some serious, small laboratory experiments and computer programs to design and prove the validity of shields for specific aircraft without flight tests. It is expected, however, that it will be possible to reduce gross shield weights after they are flown.

The shield flight test program with the modified F-4s ended the flight stages September 1955, and continued to March 1957, when all of the test airplanes were out and the program was terminated.

One of the most important points regarding detailed shield design is simplicity and the very large number of variables that must be considered. The main objective in many cases is not to achieve minimum shield weight because the maximum thrust-to-weight ratio for a given engine power is affected by inlet air duct design as well as the shield configuration. Pressure drops in the duct must be lowered along with the shield weight or system efficiency does not benefit. ♦♦

### Douglas Flies First Turbofan DC-8 Jet

Long Beach, Calif. (AP)—Flight of the Series 30 Douglas DC-8 with Pratt & Whitney JT-3D turbofan engines was made recently.

Developing 18,000 lb. of thrust at sea level, the jet engines enable a shorter takeoff run and less engine specific fuel consumption at cruise. Series 30 DC-8s have been ordered by KLM for 6 Dutch Airlines, Iberia Airlines, Aeromexico, Air France and United Airlines. Powered cargo versions also would be powered with the turbofan.

Douglas Aircraft expects the first production model with turbofan to fly within 18 days.

Maximum gross weight of the turbofan-powered Series 30 is 111,000 lb. with maximum takeoff weight of 100,000 lb. The Series 30 DC-8 will gross 275,000 lb. with a range of 1,520 stat. mi. Cruise speed of both models will be 555 mph.

### Douglas and Boeing Order Eclipse-Pioneer Autopilot

Eclipse-Pioneer Division of The Radio Corp. has received orders totaling \$1.1 million for its transponder autopilot which is now in use on as many as 35 commercial airlines and five military services. The new orders are a \$4.4 million contract from the Douglas Aircraft Co. for the installation of the Navy A-4D Skyhawk, and a \$2.6 million order from Boeing Airplane Co. for services for the Boeing 707 and 720.



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Kinetics switches are used in missile safety systems, destruct circuits, telemetry applications, battery transfer and a multitude of other uses. Switches are now being supplied for three major intercontinental ballistic missile programs, are land-based and are submersible. They launch intermediate range ballistic missiles, two missile maneuver missile programs and three space vehicles.

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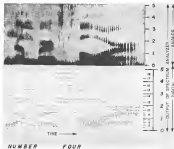
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**SPECTRAL INTENSITY** of two spoken words, "number" and "four" is shown in analog (top) and in digital form below. Numbers along vertical axis represent intensity of sound energy passed by one of 15 bandpass filters in spectrum analyzer.

vicinity of the word. One of the 15 subjects would speak the word "one," "two" or "three" into a microphone and the computer would then automatically give one of the following types of responses:

- That was false; please speaking the digit four.
- Can not identify speaker, but the digit was four.
- Can not identify speaker or the digit, repeat and speak more distinctly.
- A fourth possibility, in which the computer identifies the speaker but cannot identify the word he spoke is not yet possible with the experimental system. However, Petráš also felt it appears feasible with at least a fair degree of accuracy and is under active consideration.

#### Adaptive Recognition

AFCLRL scientists developed two self-adjusting programs intended to enable the computer to adjust itself to a new speaker for which it has no preselected mask. The first requires a human operator to make coarse decisions, while the second requires no human intervention. In both cases, the words of words which comprise the computer's stored vocabulary are spoken by one or a group of speakers.

When a human instructor is available, the computer makes a positive identification of it finds sufficient correlation between a word spoken by a new speaker and a similar word in its storage. If the correlation is only moderate, the computer makes its best guess, points it out and asks the human

operator to type the actual spoken word into the machine. The computer then adjusts its mask accordingly to be sure it has such a word in storage. If so, the machine then builds its original stored word mask to incorporate a larger fraction of the characteristics of the word just spoken by the new speaker than it would have done if it had made the correct choice.

If the word voiced by the new speaker sounds completely different from any of the computer's word masks in storage, it asks the human instructor for assistance. He then types in the word just spoken and the computer searches its memory to see if it has such a word in storage. If it finds the word, the original stored mask is modified to a still larger fraction of the newly spoken word characteristics.

#### Computer Question

Whenever the correlation is so poor that the computer must ask for human assistance, either to modify its choice or to identify the spoken word, the computer will ask the speaker to repeat the word. If the machine again has trouble identifying it, an increasing fraction of the word's characteristics is introduced into the stored mask. If the computer still has trouble after several repetitions, it either stops or, in the opinion of the user, it replaces the original stored mask with the last repetition of the word.

The second adaptive learning program, which requires no human intervention, automatically adjusts the



**IBM Produces Thin-Film Memory Plane**

Cryogenic thin-film memory plane (left), consisting of 150 cryogenic elements built up in 17 layers, providing 40 bit storage plus access and switching between memory planes, has been produced by International Business Machines Corp. using new innovative control techniques. Wafer-level selection is accomplished with separate operating at room temperature. Fabrication of thin-film memory planes is carried out in cryogenic vacuum build-up by means of sequential deposition process using 17 automatically adjusted masks. 100% yield that process automatically produces duplicate memory planes with similar characteristics once the masks have been properly aligned. Yield is controlled to 10<sup>-6</sup> per unit.



amount of stored mask modification and the fraction of the new spoken word characteristics used in this modification, is a function of the amount of correlation between the new spoken word and the original stored mask. But the self-learning program may not adapt to the new speaker's voice, AFCLRL tests indicate.

Because it is so fast and quick, to record word masks for a new speaker, it may be simpler to ask a new operator to run through a brief training routine in which the machine produces new word masks tailored to his manner of speaking, Petráš indicated.

Heart of the pattern recognition technique used by AFCLRL is a vocoder, containing 15 bandpass filters, which decomposes each spoken word into 15 frequency segments in the audio band. The output of each filter goes to a corresponding spectrum analyzer which measures the power density of the word in that segment of the spectrum.

The output of each spectrum analyzer therefore represents the magnitude of the sound energy in its segment of the audio spectrum. The output of the spectrum analyzer will vary with time as the intensity of the sound stands vary.

The output from each of the spectrum analyzers is sampled in sequence by an analog-to-digital converter (analog-to-digital), then converted into a three-bit binary number which represents its amplitude.

The rate at which the spectrum analyzer outputs are sampled, and the number of such samples used in judging the stored mask, depends on part

upon the number of words in the operational vocabulary and the relative difficulty of discriminating between near-sounding words. The larger the vocabulary and the more difficult the discrimination task, the higher must be the sampling rate and the larger the number of samples used in the stored mask.

In AFCLRL experiments, the sampling rate used was 50 per second. The number of samples of each spectrum analyzer output used in the stored word mask was varied between three and 15 per word.

Because of the different character-

istics of different words, evaluation was used to that the stored mask of every word would have the same number of samples.

AFCLRL scientists conducted experiments intended to evaluate the computer's accuracy of voice and word recognition as a function of the number of samples per word used in the stored mask and as a function of the number of frequency segments into which the word was decomposed. The latter included decomposition into 15, six, six and three frequency channels.

Following are some of the results of

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### Ocean-Based Vortec Navigation Aids Tested

Quang-gang Vortec on the Coast Guard Cutter Andromeda has just completed three week tests in Ocean Station Charlie, 590 mi southeast of Greenland as part of Federal Aviation Agency program to evaluate use of ocean-based Vortec navigation aids soon for North Atlantic. Nearly 700 aircraft utilized the Andromeda's navigation system during three week test period. Ship carries a VOR/DME station (2) mounted atop a 75 ft mast with 10 ft diameter counterpoise below, and stabilized in pitch or roll, while Vortec station (1) atop a tripod mast is stabilized for ship roll up to 30 deg. Both are connected to changes in the ship's heading.

These tests, using spoken depth "area" through "10", which show one effect of varying the number of complex per word and the number of frequency dig digits:

- 96.7% recognition using nine sample and nine frequency channels
- 96.1% recognition using five sample and three frequency channels
- 100% recognition using five sample and nine frequency channels
- 94.9% recognition using five sample and three frequency channels
- 94.7% recognition using three sample and nine frequency channels
- 85.6% recognition using three sample and three frequency channels

Because of storage limitations in the Cambridge Computer, spoken inputs (words) were limited to no more than two seconds duration in the AFCEC tests.

Words of greater duration could be handled with a computer having greater storage, but words still must be spoken as individual words separated by distinct pauses, or means used to develop "language" continuous words into distinct words. Petrick and Work on this organization problem is being carried on by several groups, he adds.

AFCEC currently is considering the use of a larger word computer and a 500 words vocabulary for further evaluation of techniques for voice com-

munication with digital computers. The degree of success achieved in AFCEC tests, using simple voice patterns:



### Fuel Cell Performs in RVX-2A

Fuel cell developed by General Electric's Mobile and Space Vehicle Department performed successfully under test conditions during 90 min. flight tests at General Electric's RVX-2A research vehicle. Televised information, transmitted on air in photo, showed no fluctuation in voltage or current in flight. Sharp changes noted occurred when voltage and load had not been applied to the battery at apogee.

area navigation techniques, "events" seem to indicate a great promise for rapid advancement in oral communication with digital computers in the near future," Petrick concludes.

Barry Petrick and Alan Willett are in the Computer and Mathematical Sciences Laboratories, Electronic Research Division of the Air Force Cambridge Research Laboratories, 1. G. Thurston Field, Bedford, Mass.

### Quartz Crystals Being Produced in Quantity

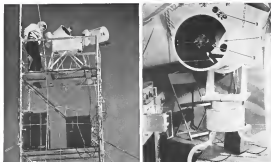
Mass production of synthetic quartz crystals has begun at Western Electric's Monmouth, N.J., Works factory at North Andover, Mass.

Crystals, used in frequency-controlled equipment, are grown in 20-18-in. long 14-in. dia. vessels. Seed crystals of natural or artificial quartz are suspended in upper half of vessels; lower half is filled with chunks of natural quartz. Work cells' solution is poured over the chunks and the vessels then heated to "900."

Quartz chunks dissolve under heat and pressure (approx. 25,000 psi.), rise to the cooler upper half of the vessel and there redeposit on seed plates.

The overall cycle takes approximately three weeks.

Western Electric now produces 70,000 units (each approximately 10 in. long, 14 in. square) from 20,000 lb. of raw natural quartz annually.



**SOLAR COMMUNICATIONS** (left) part of experimental solar communications (SOCOM) system (AW May 2, p. 164), developed by Electro-Optical Systems, Inc., under the Fovea contract; gather sun's light, modulate and retransmit it to receiver 8 mi. away during recent Mojave Desert tests. With special filters system simulated transmission over millions of miles in space. Receiver of experimental solar communications system (right) consists of a double sensor system: a photomultiplier, signal processing and control gear. Two Molectron system is a Charge-coupled array, one in which light impinging on a phosphor screen (1) is reflected in a second mirror (2) and focused back through a hole in the lens. Receiver with photomultiplier (3) for measuring solar power is shown made in test during field tests in the Mojave Desert.

## Solar Communications Prototype Tested

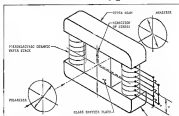
By Barry Miller

Edward AFB, Calif.—Desert field tests of an experimental communications system which employs the sun's light as an information carrier recently demonstrated the feasibility of obtaining long distance space communications using optical frequencies.

The tests were conducted by engineers of Electro-Optical Systems, Inc. of Pasadena, Calif. Equipment under test was a prototype of Electro-Optical's SOCOM (solar communications) system (AW May 2, p. 164).

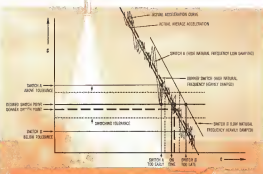
The equipment was developed for the U. S. Air Force's Wright Air Development Division under an 18-month, \$467,134 contract.

Purpose of the tests was to develop to see if prototype equipment operated satisfactorily and to show that optical systems are suitable for space communications. An eight-inch, line-of-sight system of and desert area was selected for the tests because of the absence of background light along the transmission path and the relative freedom



**MODULATING VOLTAGES** applied to piezoelectric (bottom transducer) stack produce stress in rigid beam supporting a cross-hatched glass plate of the stressed plate deflection. These stress also optical properties of glass, changing plane of polarization of light passing through the electro-optic modulator employed in solar communications system. This modulator makes possible the transmission of information by the solar communications system over simulated distances of at least 7 million mi.

## There's only one reason to specify Donner acceleration switches



..BECAUSE THEY UNDERSTAND THE MEANING OF ACCURACY

*It's dynamic accuracy that counts. In truth, several firms make precision acceleration switches. But accuracy, the reliability, is a term with shades of definition. Some switches are accurate in the lab or on the test bench. That is, they provide static accuracy. Donner acceleration switches give you accuracy when it counts, on the operational muscle. They are dynamically more nimble.*

Look at the graph above. Under static conditions, switch "A" with a better switching response, might be desirable. But suppose the muscle went experiencing a 10 g vibration at a high frequency nature and proper thrust stuff depended on detecting a 2 g switch point. Switch "B" would eliminate the problem of early switching, but introduce undesirable phase shift which in turn would make the switch "use" the event after it actually occurred. In other words, under the dynamic conditions of muscle and sensitive fields, it is absolutely necessary to know when an event materialized rather than precisely where it occurred. Frequency response becomes a more important consideration than switch accuracy.

Nearly damped, with a high natural frequency, Donner acceleration switches have low phase shift providing the transient response necessary to follow rocket engine

operation and perform their task with meaningful accuracy.

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See Page 26 under the heading—For complete technical information, write for my new brochure, *Donner Acceleration Switches for Dynamic Measurements of Flight Instruments in Aircraft and Airborne Vehicles. Please address: Dept. 20.*

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from atmospheric absorption or scattering.

Long distances over which this or other optical systems might be required to transmit or receive were simulated by attenuating the intensity of light beams with special filters located in the transmitter and the receiver. According to Electro-Optical, test results with this equipment indicate that:

- Information can be transmitted at least two to three million miles using a transmission rate of about 10 bits/sec. at minimum range. Light signals without information content were received over 10 million simulated miles. In fact, the receiver could be transmitted over the latter distance. Electro-Optical engineers say, by including light transmitter collector mirrors over the 12-in. reflectors now employed. Various distances were modeled by use of suitable filters chosen on the basis of inverse square law calculations.

- Signal noise ratio of 16 db. (measured to the receiver preamplifier output) was obtained for simulated transmission distance of 1 million mi. Bandwidth was 25 cps.

Communication and radar systems which use optical double light, infrared or ultraviolet rather than conventional radio waves have attracted special attention in the past few years. In space these systems would be free of atmospheric effects which would severely curtail their usefulness in line normal applications. Possible value in space might range as the weights and relative inaccessibility to jamming provided by narrow beams of light. Additionally light weight, reliability and low power needs at signal and associated electro-optical or electronic equipment are among other advantages frequently claimed for optical systems.

The growing interest in optical wavelengths for signal processing systems was further stimulated by recent success in generating relatively coherent light with optical Maser Optical Masers should provide power sources, light intensity beams down ten beams handled by SOCOM's Beam width of light generated by Bell Telephone Laboratories optical Maser (AW Oct. 24, p. 72) was 0.1 diam. This is a fourth of the 4-in. diam of sunlight gathered in by SOCOM's plan collector system and employed as the basic source.

Several weeks ago Air Force outlined its requirements for a sun-powered optical Maser transmitter (AW Dec. 5, p. 92). Unlike the SOCOM system, this device would rely on the sun as a pump, or power, source for an optical Maser whose output would be the information carrier. Small contracts, probably less than \$50,000 each, are expected for the sun-powered trans-

mitter and a separate modulator-developer unit. Electro-Optical especially is one of the leaders.

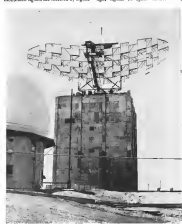
SOCOM's transmitter consists of a lightweight mirror antenna system which collects the sun's rays and focuses them through an electromechanical modulator, then transmits them from a second mirror system toward the receiver. Each mirror system use Chromatone arrays (double convex) with one focusing reflected light back through a hole in the other. These two dual mirror systems placed light to be picked up from one direction, recent in another. A solid-state radio tracking modulator (AW Sept. 24, 1958, p. 75) mounted above the first mirror system steers the antenna toward (p. 26). The transmitter's antenna gain is 33 db.

At the receiving end, transmitted modulated signals are received by a fine

probe mirror, reflected back, spent a second mirror in the Cassegrainian array and reflected through the eyepiece in the eye. Signals are detected by a photomultiplier, conventionally passively and read out. The receiver's field of view is four meters.

Total power required by the transmitter is roughly 10 watts, about equally split between modulator and transducer. Operational version of SOCOM employing lighter mirrors in place of the glass ones now used is expected to weigh between 30 and 40 lb., company engineers say. As part of a separate project, but applicable to SOCOM, the company fabricated a 1.5-in. diameter mirror displaying high optical quality. Density of this mirror is 0.8 lb./in.<sup>3</sup>

While these field tests may establish the feasibility of tracking and receiving light signals in space environments,



**Air Defense Command Radar Site at Montauk, N. Y.**

Sperry ATTS 35 long-range surveillance radar system at USAF Air Defense Command's 37th Radar Squadron, Montauk, N. Y., is 35 ft. high, 124 ft. wide and is mounted on an RTH tower. The first priority search radar is part of Air Defense Command's frequency diversity program, designed to have an reserve to ground, and thereby reduce the jamming power, or else accumulating in time in enemy airborne ECM equipment. Installation is one of 170 frequency diversity radar planned to be operational by mid-1964.

they do not resolve the difficulty in locating a receiver (or acquiring a target)—regarded as a major stumbling block in this field (AV Dec. 16, 1986, p. 57). Because of the large distances over which such systems would operate in space and the narrowness of optical beams, vast on-board acquisition technology might be needed.

Among the several modulation evolutions during the field tests, the most promising, capexes have up, is a crystal analog of the Kerr cell. This is called a stressed plate shutter. The Kerr cell is one of several types of modulators suggested for optical communications (AV Feb. 25, p. 65). Normally, in the Kerr cell, a liquid-

crystal nitrobenzene—studded by two electrodes is placed between two polaroids.

As one of the polaroids are aligned so that light does not pass through them. Applying a potential across the plate shutter changes the liquid's properties (after phase of polarization) and permits light to pass as a function of the applied potential.

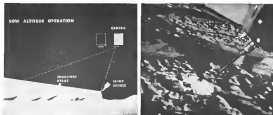
Compared with the Kerr cell, the stressed plate shutter, according to Electro-Optical, requires less voltage (by a factor of about 10), is more rugged and does not employ a toxic liquid.

A glass plate replaces the nitrobenzene in the stressed plate shutter. Necessary changes in the index of re-

fraction of the glass are produced by stresses perpendicular to the direction of light passage. The result is a change in the phase of polarization.

The glass is connected between two beams. Two beams transmit under stress join the beams each at right angles. An modulating voltage are applied to the racks they expand or contract. Stress can be transmitted through the cracks and the beams to the glass, producing a change in its index of refraction.

The SOCOM series probably will be delivered to the Communications Laboratory at WAFB sometime after the first of the year, although the delivery date is not yet firm.



**RADAR** for Republic F-105 operates on high intensity light source illuminating relief map of target area and a chondulent television camera to selectively illuminate ground mapping video operation at all altitudes, from hovering level to 100,000 ft. Light source moves over relief map, corresponding to aircraft position, and moves up or down in aircraft altitude changes. Television camera does not change height, but shifts position and is inclined slightly for low-altitude operation. Light source illuminating map is shown at right.

## Terrain Radar Simulator Uses Television

**Reensdale, Md.**—Photographic training device which gives a simulated radar presentation of ground terrain and targets for both low and high altitude flight conditions will soon be delivered to the Air Force.

The all-altitude radar simulator was developed here by ACF Electronics Division of ACF Industries for use with the Republic F-105D light simulator which the company is building.

The ACF training device is a marked departure from previous radar simulators that used time-dimensioned strips of the terrain placed under water in a large tank with an electronic transducer to transmit sound waves through the water which were reflected back from the submerged model.

The new radar simulator also uses a 3D model of the terrain to be simulated, but visible light and chondulent television have now been substituted for

the more reliable electronic system. The 3D terrain-target model is constructed to scale from plastic and then covered with powdered soot that terrain and targets on the model will reflect visible light proportionately to the real terrain/target reflection of color energy.

To simulate ground clutter return, the hills and ground of the model are coated with powdered black carbonaceous, while trees and lakes are painted black to they reflect no light. Concrete buildings and bridges are painted white, because they are strong radar signal reflectors, while water radar targets are painted gray.

The terrain-target model is illuminated by a high intensity light source which can be moved over the model so its position corresponds to the position of the simulated aircraft in flight, and the light source's height above the

model corresponds to the simulated aircraft's altitude. The light source moves over the terrain-target model in synchronism with the simulated aircraft movement.

Elimination from the scene loop in the light source poses through a four-lens synthetic aperture rail, which opens to F/16 in at its tip. This produces a light beam which is shaped somewhat like the concentric-squarish beam employed by airborne ground-mapping radars. The terrain-target model therefore is illuminated as much the same way as the actual terrain-target area would be seen as a radar radar. For example, at high simulated aircraft altitudes, only the tallest mountains produce shadows, while at low simulated altitudes, even small hills produce shadows.

The visible light reflected in varying degrees from different portions of the



## SPEARHEAD INTO SPACE

Created by Aerolab, the ARD D-4 four-stage sounding rocket is now being used by NASA for the low cost acquisition of important data at high altitudes and velocities. A wholly owned subsidiary of Ryan Aeronautical Company, Aerolab has developed more space probes and rocket-powered research models, including the Mercury capsule model, which have been fired, than any other firm in the United States. Aerolab is a science team with quick reaction capabilities—a group of scientists and engineers with special talents for solving advanced problems in astrophysics, aerophysics and geophysics. Thus Aerolab's capabilities are added to Ryan's own in accomplishing breakthroughs in many vital areas of Space technology.

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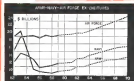
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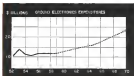








**ARMY-AIR FORCE EXPENDITURES:** Army estimates will be comparable throughout for several months and showed that we capabilities becoming fully effective by 1967, but with a concomitant that effort be made to stay it out by 1975. New estimates cover missile offensive and defense equipment for ground and defense, missile modernization of missile fighter bomber aircraft, but a Future force information program at least that continues to permit finding of nuclear weapons killing. Air Force program shows completion of the Titan and Atlas program and about 75% of present Strategic plan. Multistage must be placed in order to increase nuclear and other units. B-71 is included in a major system, but to be late four ways by 1969. Future Air Command S-100, fighter and Military Air Transport force modernization is included. Defense force and missile are included at rates comparable to their military programs. Air Force costs though higher in funding, such a high in 1970 because of high costs of S-100, F-15's and military mobile programs. In 1960, some cost reduction is expected through elimination of aircraft study and deployment and improved technical expenditure.



**GROUND ELECTRONICS:** is projected as a conservative but real growth expenditures are likely on major existing programs.

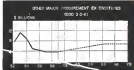
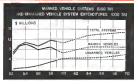
long expenditure, who at it or approach me the retirement age. Research expenditures and scientists at missile expenditure are steady.

It is clearly important that the military people fully understand that they will not return to their former career. The civilian people must be given to clearly understand that they will not return to their former career employment or military after completion of their work with the government. This is necessary to avoid the self-interest to demand that is often wrongheaded thought against people in this type of work.

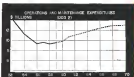
Some fine work has been done in

long-term planning in view of our tactical organizations. The General Electric study group known as Tenno might well establish a pattern for what should be done on a tactical scale.

The first program of the long-term planning group in the defense area should be a close look at rapidly specific items in our basic research program, a close scrutiny of those things which might possibly be converted to development and a study of appropriate component of these things which should be carried forward into production. These expenditures must be looked at not on the basis of what is good for the Navy, Navy or the Air Force, but on a



**MAINED AND UNMAINED vehicle systems (above, below):** These two other major programs expenditures (above, below). These two other major programs expenditures (above, below). These two other major programs expenditures (above, below).



**OPERATIONS AND MAINTENANCE:** The more our systems entering into being produce a very curve into 1960. Different effort will be needed to hold these units in line, including acceptance of old induced facilities.

both of what the real situation requires, much of that country are to protect our nation as the line of environmental competition.

The second program of our planning group is to provide the determination of what actions are necessary to provide the financial basis required to execute a long-term program. A broad look at 100 years is very general term is dramatic with a clear look at a 30-year program. We certainly can plan ahead for 50 years if the American endowments, could establish a 60-year program. We must get down to preparing for the 10-year period ahead.

The third program of our technical

and military programs would be recommendations for the consolidation of these systems and procedures which would include our total gross national product to be at least \$500 billion and possibly approaching \$550 billion by 1970. This is the establishment of a national goal, a goal for government and a goal for private enterprise, in total productivity concerns with due consideration to how our private enterprise systems fit into the solution of specific problems that may arise. Part of the job of our long planning group for the U. S. must be to present new ways ahead the greatest possible strength for the economy, military, and social organization that we have achieved in the last 150 years.

Central planning and establishment of broad policies for military, industrial and economic programs on a long-range national scope is essential to progress. The transfer toward the expansion of governmental businesses into a state pocket of controlled activities must be needed at all cost.

#### Population Factor

If we are to insure the next decade to be one of reasonably full employment, we should not expect population increases to be relatively stable. In checking authorities such as the Bureau of the Census and the projections of some of the more conservative of the country, it appears that we are expected to have of the order of 215 million people in 1975. Of course, the labor force available in 1970 is reasonable well established by people now on board, and therefore will depend upon the percentage of work force who are both willing and able to work.

The tendency toward early retirement in the past decade has been actually declining because an increasing number of people have found it difficult to work in their capacity level of output when producing the age of 65. We were therefore, just a working off, but not a decline in the participation of the male population. On the other hand, almost all authorities forecast an increase in the participation rate of females for the 1970 time period. We find little prognosis of a total labor force of 50 million with 15 million in the armed forces. It is reasonable to believe that with increasing automation and the increasing efficiency of our military organizations, we could project the Armed Forces to be reduced to about 21 million by 1970. This could be secured by modernizing our entire Department of Defense structure.

We have had an increase in the gross value added in the long-range output and equipment of more than 15% above what we had in the early 1930s. It is estimated that the total value added now stands at \$780 billion. It is believed

that the growth rate in plant and equipment during the next 30-year period will be high enough to reach a total of over \$1,000 billion.

Obviously, in order to keep the new facilities will have to run substantially above the level of the last 30 years. The trend in normal reference cost with increased automation and increased productivity in our plant to reach the low labor costs of our foreign competitors.

The facilities available on an industrial sector in our country in 1970, can rise to a level of \$11,000 for worker in 1950 to on the order of \$15,000 per worker in 1970. In the past period about one-third of the working man's income in productivity has been devoted to shortening working hours and about two-thirds to increasing the effective output per man-hour. Since World War II the total income in productivity per man-hour has been on the order of 2.5% per year. This resulted in an increase in output per man per year from \$3,700 in 1940 to \$6,500 in 1970. In the 30-year projection to 1970 it is conservatively estimated that about 2,500% per annum increase will be obtained. It will in all probability reach over 50,000% output per worker per man in 1970. This comparison is most interesting because it shows the real effect of automation. It is obvious that increased automation and the application of advanced technology in the form of our high productivity of output.

These views again it took 52 to plant investment to produce 51 of output per year. That is a new progress so that 51 56 in plant will produce \$100 output per year. It is projected that 1.6 times this new \$3.15 of capital investment will produce \$100 of output. This alone with the overall increased industrial productivity and the higher productivity level of output, from these should provide a major impetus to increasing our annual rate of growth in gross national product.

The whole basis of the assumption of continued high growth would include the combination of the two most logical and probable steps, in our opinion, of higher output per man-hour and new technology in the long-range output plan that is widely concentrated and widely understood in all levels of management and labor. This combination should permit easily maintain a desired



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gross national product of \$550 billion in 1970.

Projections by authorities of annual increments of our gross national product across the period 1966 to 1970 vary from a low of 3% increase per year, based on what has actually happened over the last 50 years, to projections of 12% to 15% based on what has happened in the last few years since World War II. It is interesting here to note that most sources have been decreasing a potential annual growth rate of 4% while other non-defensive economists have indicated a possible growth of at least 5% per year.

The importance of growth rates may be checked if we consider the position of Khrushchev. He said in 1959 that the planned Soviet economy, while only 40 years old, is already able to challenge our 150-year-old capitalist state in economic competition in many areas, and is outgrowing it as others choose to select such as the space race.

I am sure the Russian projections are based on the fact that they are looking at an average growth rate of the U.S. of around 4% in the 1968-1970 time period with a projected average growth rate of the Soviet across the same period of between 4%.

#### Predictable Utilization

At the same time, the Russian is looking at a probable reduction of 5% in percent reducing to about 5% in the future of our gross national product by the expenditure. In his own projection the Soviets devote on the order of 15% to their security program. Obviously, if this is done on the basis of conservative projections of their own, they will tend to plan to spend more for national security than we do in the period 1965 to 1970.

Since our total national production will still grow, there being that of the Russians, we are still at a position to take the active economy to maintain our superiority, both in the economic and military areas. This can be done,

however, only if we concentrate our efforts on maximizing the capability of our civilian economy.

This projection shows us the order of \$215 billion by 1970. This is conservative compared with what we could really accomplish. It appears logical that if we really go to work, we can do a national and an individual here we could create \$450 billion in gross national product in 10 years. Certainly no choice ever allowed to be in a position where the Soviet military program would cut away in quality and effectiveness. Certainly we cannot afford on a national or an international basis to permit their efforts, and were we permitted, their results in space exploration to be greater than ours. These targets can be easily met by using 10% of our expanded gross national product. It is obvious that the present program now at about 9% of gross national product for defense and 10% for non-defense has not affected our national economy because our sale of weapons, our sale of living, the standard of liv-

ing of all our people has increased annually at a much greater rate than the gross national product itself. I think most economists agree that we could spend up to 15% of gross national product for the defense portion of our economy without harmful effect.

The importance of our maintaining effective language targets and long-range plans in that such a procedure will be a major factor in our defense build-up. The defense build-up will provide a challenge to our allies and a warning to our enemies. The growing economic and political strength of our allies will enable them to secure an increasing portion of their own defense budgets. They too also expand their role in meeting the protection of the economic development of the underdeveloped countries. This can be provided as incentive for the "have not" to reach for the democratic system of government and the free enterprise system of management of industry.

We can stand firm against the present Soviet threat and we can stand firm against China if we really have the desire to do so as a nation, and if we plan for that sort of action. However, there are many things we must do. We must be able to shift emphasis in the utilization of our resources, to work long enough hours to produce enough results in quality and quantity of material. We must be willing to pay more, but, if necessary, to require the labor in defense and space exploration, to establish a truly higher level of education of our children, and to maintain the scientific leadership of the world.

#### New Offerings

**Hydrosystems, Inc., Bloomfield, N. J.**, engaged in the design, manufacture and sale of ball valves. Offering is (1) 100,000 of debentures due Jan. 1, 1971, and warrants to purchase shares of common stock of the company price of \$1.00 per share. Public offering price of the debentures and warrants is \$1.00 per share. The debentures and warrants to be offered in units consisting of a \$1.00 debenture and one warrant, and (2) 20,000 of common stock. Public offering price of the debentures and warrants, terms of the warrants, and the conversion price to be supplied by underwriter, public offering price of the common stock will be a level price determined by the selling underwriter and the underwriter. Offering also includes an additional \$200,000 principal amount of debentures, with warrants attached, which are being offered by the company, at the public offering price less the underwriting discount, to dealers, officers, and employees of the company, et al, who have indicated an interest in the company's efforts. Proceeds of the sale of the sale of debentures and warrants will be used to retire bank loans.

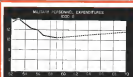
Offering which were used to pay for landfill improvements at the company's new Bloomfield, N. J., plant, to purchase additional machinery and equipment during the next twelve months. The balance to be added to working capital.

**Electron Tube Corp., Philadelphia, Pa.**, engaged in the design, manufacture and sale of single gun and multiple gun cathode ray tubes, single channel and multiple channel oscilloscope tube microscopes, and associated electronic devices, for use in the aircraft, missile, and other defense industries requiring a lot of electronic data. Offering is 100,000 shares of common stock for public sale; offering price and underwriting terms to be supplied by underwriter. The proceeds, \$100,000 will be used to acquire equipment and to begin production of high resolution magnetic tubes and cathode ray storage tubes. \$100,000 will be used in the design, development and applied toward the purchase of equipment and components for the development of new specialized types of multi-channel cathode ray tube oscilloscopes, \$60,000 to repair equipment, and \$40,000 to repair equipment. Underwriter is Kennedy, Macdonald, & Co., Inc., a Delaware corporation, organized in November, 1960, to acquire all the issued and outstanding shares of capital stock of Shasta Engineering, Inc., a California corporation organized in 1957, and General Electric Corp., a Delaware corporation organized in April, 1902. All of the outstanding shares of the subsidiaries were acquired in November, 1960, in exchange for a total of 200,000 shares of common stock of the company. These subsidiaries, the company is now engaged in the manufacturing, assembly and sale of aircraft and missile components, and is a subcontractor, primarily for defense purposes, in the design, engineering, manufacture and installation and/or correction of industrial and research facilities and equipment, and in the production of electronic equipment. Offering is 100,000 shares of common stock for public sale at \$6 per share. Also, the company will issue to the principal underwriter, \$10,000 immediately convertible warrants, at \$14 each, entitling the holder thereof to purchase from the company one share of common stock at \$6.00 per share and at price increased 66% per annum thereafter for the next five years. The underwriter plans to offer 1,500 of such shares to the public following the completion of this offering at the prevailing market price.

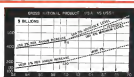
In connection with computers and electronic data processing equipment or systems, it is also engaged in research, development, and the manufacture of other electronic and electro-mechanical systems and equipment. Offering is 100,000 shares of common stock. Of such stock, 55,000 shares are subject to purchase upon the exercise of warrants, of which 45,000 were issued pursuant to \$2,150,000 of 15% subordinated debentures in the sale of one series of 100,000 shares of common stock for each \$50 of debentures and 10,000 were issued to Putnam & Co., Inc.; the 15,000 shares were registered effective Jan. 1, 1960, under the Securities Act of 1933. 10,000 shares are owned by Audemus Nicholls & Company and are subject to purchase by three individuals to whom options have been granted for purchase at \$5.50 per share. The 55,000 warrants are exercisable at \$16 per share to end including Dec. 31, 1961, and at \$17.50 a share thereafter until their expiration. Proceeds from the sale of stock pursuant to the exercise of the warrants will be added to the company's working capital.

**Shasta Industries, Inc., Wilmington, Del.**, the company was organized in November, 1960, to acquire all the issued and outstanding shares of capital stock of Shasta Engineering, Inc., a California corporation organized in 1957, and General Electric Corp., a Delaware corporation organized in April, 1902. All of the outstanding shares of the subsidiaries were acquired in November, 1960, in exchange for a total of 200,000 shares of common stock of the company. These subsidiaries, the company is now engaged in the manufacturing, assembly and sale of aircraft and missile components, and is a subcontractor, primarily for defense purposes, in the design, engineering, manufacture and installation and/or correction of industrial and research facilities and equipment, and in the production of electronic equipment. Offering is 100,000 shares of common stock for public sale at \$6 per share. Also, the company will issue to the principal underwriter, \$10,000 immediately convertible warrants, at \$14 each, entitling the holder thereof to purchase from the company one share of common stock at \$6.00 per share and at price increased 66% per annum thereafter for the next five years. The underwriter plans to offer 1,500 of such shares to the public following the completion of this offering at the prevailing market price.

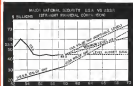
The proceeds from the sale of the 110,000 shares of common stock, \$330,000 will be used to discharge a bank loan evidenced by a note issued by Kato, the proceeds of which were



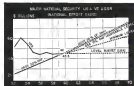
**MILITARY PERSONNEL.** By eliminating deficiency jobs and eliminating all but essential headquarters military personnel could be reduced from 2.5 to 2.1 million by 1970. This job cut does not in 1970 will be exceeded by not job cut and have a military machine out supported by its excess.



**GROSS NATIONAL PRODUCT, U.S. vs. USSR.** Personnel of the U.S. or 1950 roughly spent the Russian increase of 75% a year less than the U.S. gross national product than that of Russia in 1970. But in 1970 the U.S. gross national product was three times Russia's.

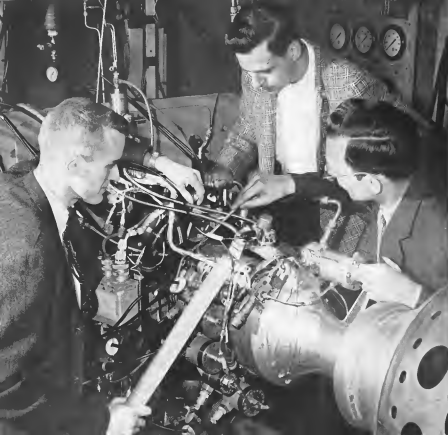


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I deal with interest the typical way you do. I issue (p. 92), giving details of the financial statements before the American Chemical Society, concerning the estimated number of fire accidents with benzene fuel I would like to examine in some of these statements, but first of all I did when in this country after our latest negotiations to American Airlines (and, indeed, to most other US airlines) for clearing increases for their future potential activity. This is a simple step forward in increasing the safety of an issue.

(1) I am supposed that for the 38 months under review Mr. Board was able to find as many as 33 words that he has marked secret? As he does not say otherwise, I can only assume that that figure must include a large number of very minor incidents in which no one would be expected to take any special notice.

(2) Mr. Bond is correct in stating that his figures are probably less compressing the safety of the two jet links in commercial operations, this is particularly because, unfortunately, the only commercial use of JF-4 was TCA and in their general safety record it is a very high order of a doubtful whether such low incidents as they have had can make any statistical difference.

It follows from this paragraph, however, that P-6 cannot be significantly safer than the gasoline because in almost all accidents it will be at a temperature above its flashpoint. From the standpoint of fuel tank explosion in flight and on the ground (both during refueling and offloading a tank), kerosene is much the safer by most circumstances where P-4 is not dangerous than gasoline.

(3) Mr. Bond states that the position of strike debtors has been considered a matter based on handling insurance. This has certainly caused some confusion and has

that someone has secretly been conducting tests on the U.S.A. but as the country is so well known (Shell Co.) it is impossible that the findings have not been made. It is an odd case between America and P.T. 139. This particular compound is being tested on a domestic market, it is thought to be the best of the chemical based ones and to be the best of the products of industrial state. It is still coming with very high rates of efficiency and this must always be carefully watched, but the people always be not in P.T. 139 which will really produce evidence before they show themselves will not. This follows from how before, within, etc.

The authors are naturally reluctant to admit why they are changing to P4 before voluntarily for them. IFA has already let out the truth of the matter. At their 15th Technical Conference held in London earlier this year, Mr. Kari Skjovp (of SAS), who led the committee on jet fuels, admitted that as P4 tended to become obsolete, then kerosene more operations would be going over to it. Let us quote Mr. Hansen: " ... because a DATN, which

needed standard specifications but the 8 social people want us to talk up the aircraft with knowns in one place and JF-4 in another.' While the civil entry matter is dictated by the finance people, I cannot but wonder what the engineering people can do.

As an illustration of how "two birds" in silicon can be seen in the matter, allow me to refer again to Mr. Haggren who, at the ICFIA Annual General Meeting in Capri, Naples in September, vigorously warned that we are could tell whether one bird could be seen from another. Now, in September

Can Mr. Hagood now explain why the change of face?

With regard to the attitude of the neo-orthodox authorities, it is worthy of note that the chairman of the Air Registration Board has this year twice demonstrated, in public, what he refers to as the "disagreed practice" of the use of F-4 fuel.

Finally, unless and until the country is paved, it must be assumed that the crash of the locomotive-fueled Elmore at LaGuacha in September has provided the finest example to date of the greater safety of kerosene. Those 78 people who walked out of the inverted burning wreck can be classified that they merely belonged to American Airlines and not to one of the airlines of El Salvador.

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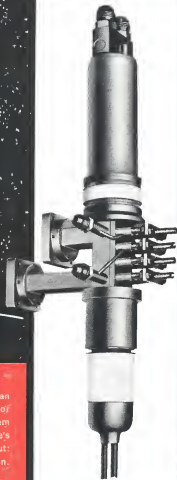
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